NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report
Second Quarter of 2025

April to June 2025

Rev	Date	Author	Checked	Approved	Modification Details
A	09 September 2025				Final
A0	26 August 2025	for. Team leaders	Khamsone XAYSOMPHOU	Wanidaporn RODE	To ADB and LTA for Review

Accessibility	
☑	Public
☐	Internal
☐	Confidential

Document No.

NNP1-O-J0905-RP-018-A

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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
ADM	Administration Division
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
BOMU	Biodiversity Offset Management Unit
BSP	Biodiversity Service Provider
CA	Concession Agreement between the NNP1PC and GOL
CAP	Corrective Action Plan
CCA	Community Conservation Agreement
CDP	Community Development Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
DAFO	District Agriculture and Forestry Office
DCC	Document Control
DD	Data Deficient of IUCN conservation status
DEB	Department of Energy and Business of the Ministry of Energy and Mine
DEMO	District Energy and Mines Office
DOF	Department of Forestry of Ministry of Agriculture and Forestry
DWP	Detailed Work Program
EC	Electrolytic Conductivity
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan

FMM	Financial Management Manual
FPF	Forest Protection Fund
FTS	Fortune Service
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
H&S	Health and Safety
IAP	Independent Advisory Panel
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
IUCN	International Union for Conservation of Nature
ISP	Intergraded Spatial Planning
KGS	Khammany General Service
KPI	Key performance Indicator
kV	kilo-Volt
LC	Least Concern of IUCN conservation status
LTA	Lender's Technical Advisor
LHSE	Lao Holding State Enterprise
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
MPI	Ministry of Planning and Investment
NC-NX	Nam Chouane-Nam Xang
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OAA	Other aquatic animals
OC	Obayashi Corporation
OFIs	Opportunity for Improvement
O&M	Operation & Maintenance
ONC	Observation of Non-Compliance

OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry
PCD	Procurement Division
PEMO	Province Energy and Mine Office
PONRE	Provincial Department of Natural Resource and Environment, MONRE
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SMO	Social Management Office of ESD within NNP1PC
SMART	Spatial Monitoring and Reporting Tool
SOP	Standard Operating Procedure
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division
TOR	Terms of Reference
TPZ	Totally Protected Zone
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UR	Upper Reservoir
VU	Vulnerable of IUCN conservation status
WCS	Wildlife Conservation Organization
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Wastewater Treatment System

EXECUTIVE SUMMARY

The quarterly environment monitoring report of Nam Ngiep 1 Hydropower Project provides information and analysis of compliance with the environmental and social obligations of the Project stipulated in the Concession Agreement between the Nam Ngiep 1 Power Company (NNP1PC) and the Government of Lao PDR (GOL), and as required by environmental legislation of the Lao PDR, the ADB Safeguard Policy Statement and IFC Performance Standards. The Company ensures compliance with these requirements through implementation of project specific sub-plans, programmes and activities prepared as part of the Environmental and Social Management and Monitoring Plan for the Operation Phase (ESMMP-OP).

NNP1PC has successfully renewed its ISO 14001:2015 certification, which remains valid until 14 March 2028, the certification covers NNP1PC's core operations in electricity generation and transmission from the 290-megawatt hydropower project. The news release on the recertification was published on NNP1PC's website and Facebook on 23 April 2025. Next Surveillance Audit is scheduled for Q1 2026.

Activities related to ISO14001:2015 implementation continued. This includes the implementation of the four (04) Environmental Management Plans (EMPs). The timeframe of the EMPs is from August 2024 to July 2025. The four EMPs include EMP01: HSE awareness training for NNP1PC staff and contractors, EMP02: Reducing the paper consumption in NNP1 offices, EMP03: Recycling the HDPE plastic waste by producing four HDPE waste bins, and EMP04: Planting trees at selected rehabilitation areas.

Three joint monthly site inspections were conducted by EMO, ADM and Technical Division (TD) to follow up on the progress of corrective actions from previous findings and any new findings. During these inspections, four Observation of Non-Compliance (ONCs) were identified. The Site Inspection Reports (SIRs) with details of findings and recommendations were submitted to TD and ADM and the issue was resolved by the end of Q2 2025.

In late Q2 2025, NNP1PC-ESD welcomed GOL joint visit by the Environmental Management Unit (EMU) and the first semi-annual monitoring mission of the Independent Monitoring Agency (IMA) under MONRE. During the visit, EMU expressed concerns regarding ongoing watershed encroachment and emphasized the need for stronger coordination between the Project and government stakeholders at all levels, while, the IMA shared positive preliminary observations, with the final monitoring report expected to be shared with NNP1PC by August 2025.

In Q2 2025, a total of 15.24 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, a decrease of 3.51 m^3 compared with Q1 2025. The local contractor maintained routine waste collection and NNP1 landfill management throughout Q2 2025.

The environmental flow requirements have been monitored in accordance with the ESMMP-OP and the results show that the rate of water level increase due to dam operations (ramping-up) in one case did not comply with the requirements.

The concentration of dissolved oxygen (DO) at the surface level in R05 (Main Reservoir immediately upstream of the main dam) ranged between 5.2 mg/L and 8.8 mg/L. The monthly mean DO concentration at the intake level decreased from 1.96 mg/L in April 2025 to 0.72 mg/L in May 2025 and 0.04 mg/L in June 2025. The DO concentrations in Nam Chian and Nam Phouan were above 6 mg/L. The DO concentrations at the surface level in the Re-regulation Reservoir

(R07) were between 1.5 and 4.7 mg/L. During combination of gate and turbine discharges in April 2025, DO concentrations in Nam Ngiep downstream the Re-regulation Dam were greater than 6 mg/L (complied with the standard). However, during gate discharge in May 2025 and turbine discharge in June 2025, the DO levels in Nam Ngiep downstream of the Re-regulation Dam were less than 6 mg/L.

The depth profile monitoring during the period indicates formation of oxyclines in the Main Reservoir at the monitored stations at varying depths.

In Q2 2025, the Bolikhamxay Watershed and Reservoir Protection Office (BLK-WRPO) resumed forest and reservoir patrols after they had received the first 6-month funds under the approved AIP 2024 from the Forestry Protection Fund, Department of Forestry, Ministry of Agriculture and Forestry (FPF-DOF-MAF) in April 2025. In May 2025, BLK-WRPO submitted their funds disbursement request letter for their AIP 2025 to Forest Protection Fund (FPF), Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF). As of June 2025, the requested funds had not yet been transferred.

In Q2 2025, XSB-WRPO did not conduct patrolling in the Totally Protected Zones (TPZs), watershed forests, or reservoir areas due to delays in submitting the 2025 activity plan to NNP1PC-EMO and BSP-WCS, as well as the financial report to XSB-WRPC. A monthly meeting was held to review the prolonged delay in activities and to finalize the Fishery Co-Management Plan and Regulation. The FCMP was endorsed by the Xaysomboun Provincial Agriculture and Forestry Office (XSB-PAFO) on 23 May 2025. The Fisher Co-Management Regulations (FCMR) were finalized in June 2025, with final documents submitted for provincial approval by August 2025. The upstream reservoir checkpoint was completed and the downstream checkpoint is expected to be completed in Q3 2025.

In Q2 2025, Bolikhamxay Biodiversity Offset Management Unit (BOMU) conducted monthly patrols and snare removal. Conservation outreach campaign for six target villages of Nam Chouan-Nam Xang (NC-NX) Biodiversity Offset Site, Viengthong and Xaychamphone markets has been successfully implemented. Consultations with NC-NX six target villages for the Community Conservation Agreement (CCA) has been completed. Village fish conservation zones (FCZ) have been visited. BOMU received their AIP2024 second six months fund from the Ministry of Finance (MoF). The 2025 Annual Implementation Plan (AIP) for NC-NX Biodiversity Offset Site was approved.

The fish species dominating the fish catch by weight in Q2 2025 include *Oreochromis niloticus,* and four species group of Barbonymus gonionotus and Hypsibarbus, Poropuntius*,* Hampala*,* and Mastacembelus that which are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species and *Oreochromis niloticus* which is an exotic species. The recorded catch of threatened species includes three species that is classified as Vulnerable (VU): *Cirrhinus cirrhosus*, *Scaphognathops bandanensis*, and *Tor sinensis*.

1 INTRODUCTION

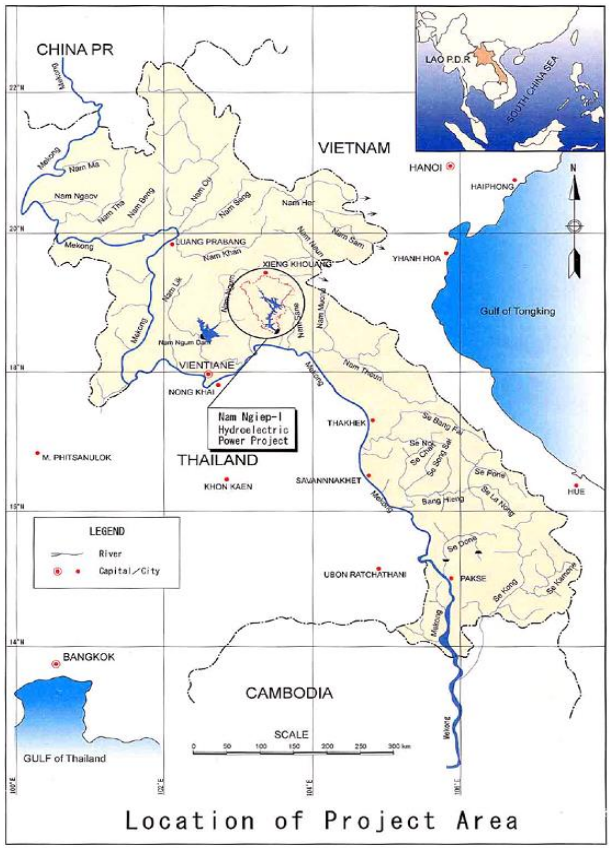
The Nam Ngiep originates in the mountains of Xiengkhouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province.

Two dams and power stations were constructed along the Ngiep River in Bolikhamxay. At the main dam site, a primary power station generated around 1,546 GWh of electricity for export to Thailand and release water to a regulating pond where a second dam and power station generate around 105 GWh of electricity for local use.

The Project Commercial Operation Date was achieved on 05 September 2019.

This Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during **Q1 2023**. The report is published on the Company website (https://namngiep1.com/).

Related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are also publicly disclosed on the Company website as required under the Concession Agreement.



2 ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental management and monitoring activities reported in this section document the implementation of the relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Operation Phase during Q2 2025.

2.1 ISO14001:2015 RECERTIFICATION

NNP1PC has successfully renewed its ISO 14001:2015 certification, which remains valid until 14 March 2028, the certification covers NNP1PC's core operations in electricity generation and transmission from the 290-megawatt hydropower project. The news release on the recertification was published on NNP1PC's website and Facebook on 23 April 2025. Next Surveillance Audit is scheduled for Q1 2026.

2.2 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q2 2025, activities related to ISO14001:2015 implementation continued. This includes the implementation of the four (04) Environmental Management Plans (EMPs). The timeframe of the EMPs is from August 2024 to July 2025. The four EMPs include EMP01: HSE awareness training for NNP1PC staff and contractors, EMP02: Reducing the paper consumption in NNP1 offices, EMP03: Recycling the HDPE plastic waste by producing four HDPE waste bins, and EMP04: Planting trees at selected rehabilitation areas.

The details of EMPs 2024 implementation are shown in **Table 2.2-1**.

TABLE 2.2-1: THE DETAILS OF EMPS 2024 IMPLEMENTATION

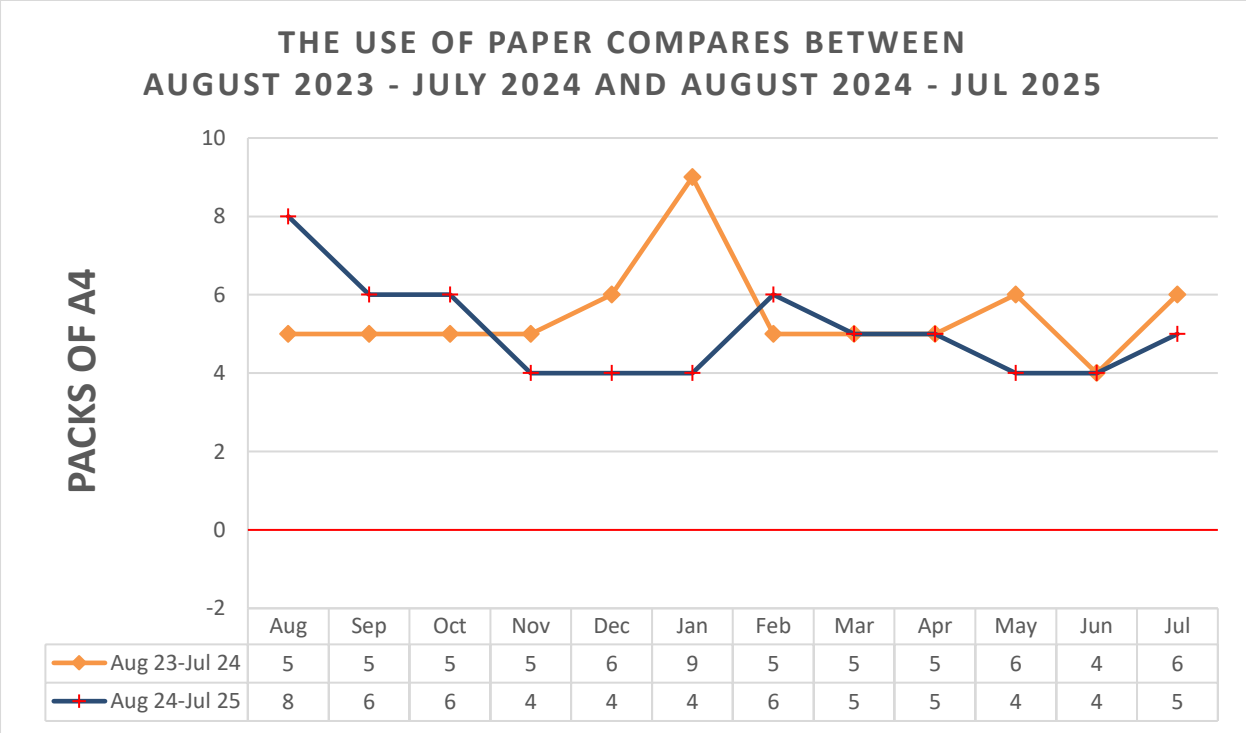
EMP No.	Activity Description	Key Performance Indicator (KPI)	Evaluation Date	Implementation Progress
01/2024*	Providing HSE awareness training to NNP1PC staff and contractors	100% of new NNP1PC employees and contractors and 80% of existing NP1PC employees and contractors will be trained in health, safety, and environmental awareness August 2024 to July 2025	Aug 2024 – July 2025	Progress: 60% trained. Training is ongoing. To achieve this objective, the annual HSE training is scheduled for end of July 2025.
02/2024*	Reducing the paper consumption in NNP1 offices	Total use of A4 paper for printing in the NNP1PC's offices (VTE, OSOV1, OSOV2) is reduced by 5% during August 2024 to July 2025 compared with the previous 12 months.	Sep 2024 - July 2025	11% reduction (KPI achieved) Continue digital reporting to GOL, with target to save about 3,500 sheets in 2025. The ongoing implementation of online leave requests and digital reporting to GoI began in June, saving around 500 pages. **See the graph below,**
03/2024#	To make at least one new product (four HDPE waste bins) from the HDPE plastic waste within the implementation timeline from August 2024 to July 2025.	Collect and sort HDPE plastic waste to produce four waste bins from August 2024 to July 2025.	Sep 2024 - July 2025	Collected a total of 50 kg of HDPE bottle caps. **On hold for producing the HDPE waste bins** due to higher machine cost. the team is currently exploring hand tools alternative for making the waste bind.
04/2024*	Planting at least 200 trees at selected	At least 50% of planted trees survive by July 2025.	Sep 2024 - July 2025	Current survival rate 39%: 77 out of 200 trees have survived.

EMP No.	Activity Description	Key Performance Indicator (KPI)	Evaluation Date	Implementation Progress
	rehabilitation areas.			An additional action to replace the 123 dead trees was conducted on 11 June 2025.

[*]EMPs implemented in 2023, continued in 2024 for further success

[#] New EMP for implementation in 2024 and futures.

- **EMP02: Reducing the paper consumption in NNP1 offices**



	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Aug 23-Jul 24	5	5	5	5	6	9	5	5	5	6	4	6
Aug 24-Jul 25	8	6	6	4	4	4	6	5	5	4	4	5

- **EMP04: Tree Replanting Activity**

The latest assessment in May 2025 showed a 39% tree survival rate. To meet the EMP's Key Performance Indicator (KPI) of a minimum 50% tree survival rate by July 2025, replanting was conducted on 11 June 2025 to replace 123 dead trees with active support from staff across departments.



2.3 CONTRACTOR SS-ESMMPS

In Q2 2025, one SSESMMP for Investigation of leakage path at J27 of the Main Dam was submitted to the Environment Management Office (EMO) for review and approval. The investigation for the leakage path at J27 on the upstream side at the right abutment of the main dam aims to inspect the leakage path from the upstream to the downstream side at J27. According to the information, the highest water impounding is causing high water leakage. Drilling, tracing tests, and grouting shall be done to reduce the water leakage at the dam foundation. On 03 June 2025, EMO issued a no objection to the proposed activity but required the contractor Kenber Geotechnic (Thailand) Co., Ltd to revise and resubmit the documents within 10 business days, addressing the following key comments:

- Provide a total quantity of the Rheobuild 1008 and Hydrochloric Acid (HCL) to be transported to the NNP1PC site, the specific storage location and the Safety Data Sheets (SDS) of these materials.
- Estimate daily volume of wastewater generated from 1). drilling activities and 2). grounding operations (based on the scope of work), to verify whether the proposed sedimentation pond capacity of 4 m^3 is adequate. indicate the exact location of the treatment system to be installed on-site.
- A site layout map showing the proposed location of the camp and its key facility including (but not limited to) accommodation areas, workshop, fuel storage, parking area, kitchen, toilets, wastewater pond, and drainage system.
- A waste management plan for the camp, covering the handling of general waste, food waste, hazardous waste, wastewater, and septic tank waste (specifying procedures for collection, segregation, storage, and disposal).

The SS-ESMMP is provided in **Appendix 6.** The EMO's comment and contractor's responses to the EMO's comments are documented in **Appendix 7**. Based on daily routine inspections and monthly joint site inspections, no significant environmental or safety concerns were identified.

2.4 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

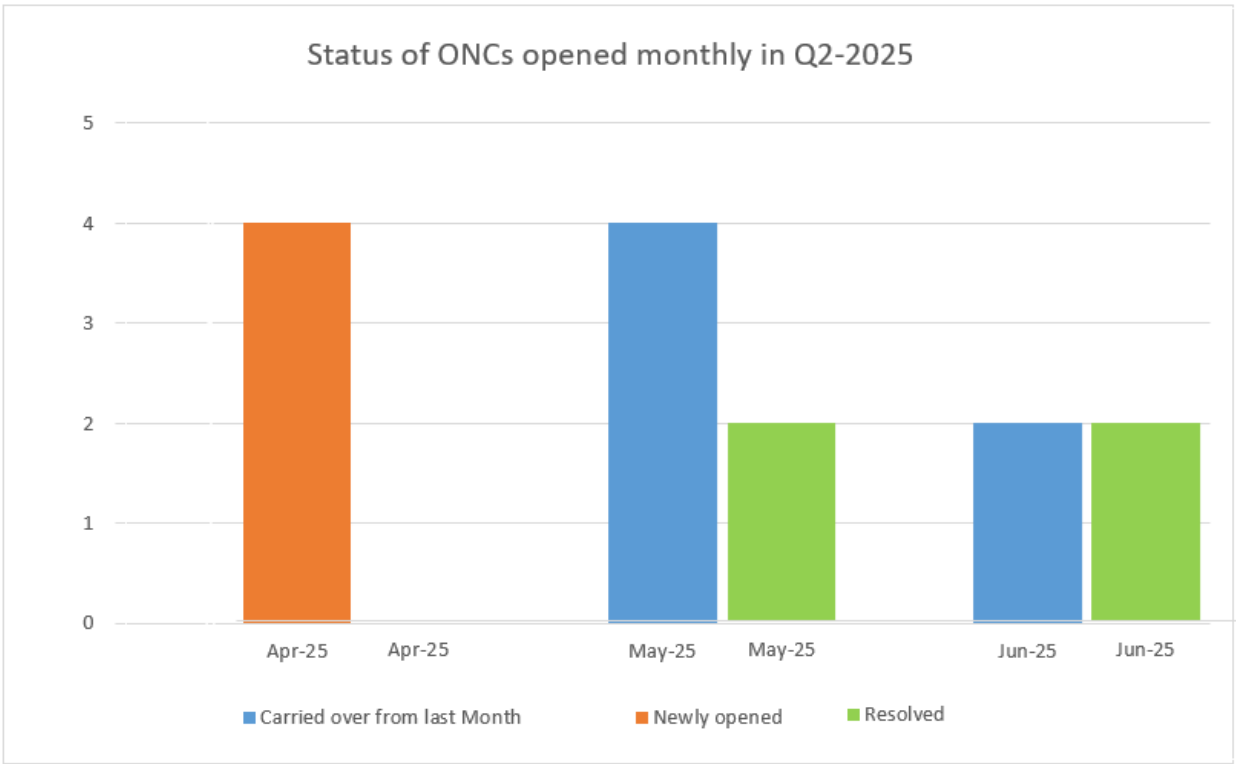
During Q2 2025, three joint monthly site inspections were conducted by EMO, ADM and Technical Division (TD) to follow up on the progress of corrective actions from previous and new findings. Three Site Inspection Reports (SIRs) were submitted to TD and ADM. During the inspection, four Observation of Non-Compliance (ONCs) were identified. Subsequent inspections have confirmed that the issues have been resolved by the end of Q2 2025.

The status of the ONC and NCR reports is summarized in **Table 2.4-1** and **Figure 2.4-1.** The Site Inspection Results During Q2 2025 is presented in **Appendix 1**: The Site Inspection Results During Q2 2025.

TABLE 2.4-1: STATUS OF ONCS AND NCRS REPORT DURING Q2 2025

Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR from the previous quarter	0	0	0	0	0
Newly opened ONC/NCR	4	0	0	0	0
Total No. of ONC/NCR	**4**	**0**	**0**	**0**	**0**
Resolved ONC/NCR	4	0	0	0	0
Unresolved ONC/NCR carried forward to the next quarter	**0**	**0**	**0**	**0**	**0**

FIGURE 2.4-1: STATUS OF ONCS DURING Q2 2025



2.5 SITE DECOMMISSIONING AND REHABILITATION

All 31 rehabilitated areas were inspected. No evidence of erosion or instability were observed at any of the inspected sites.

2.6 MONITORING MISSION

2.6.1 Environmental Management Unit (EMU)

From 17–19 June 2025, the Xaysomboun Provincial Agriculture & Environment Office, Hom District Environmental Management Unit (EMU), and NNP1PC-ESD conducted a joint Environmental and Social monitoring mission in Homthad (Hom District) and Pou (Thathom District) villages. The EMU raised concerns about watershed encroachment and emphasized the need for closer collaboration between the project and government at all levels. Additionally, EMU requested that the Social Management Office (SMO) routinely submit its annual livelihood development plan for self-resettled households in Houayxay and Homthad villages to both the provincial agriculture office and district EMU.





Environmental and Social Monitoring Mission by the Xaysomboun provincial agriculture and environment, Hom district Environment Management Unit (EMU) from 17-19 June 2025

2.6.2 Independent Monitoring Agency (IMA)

The Independent Monitoring Agency (IMA) from the Ministry of Agriculture and Environment conducted its first six-month monitoring mission of Environmental and Social (E&S) activities implemented by NNP1PC from 24 to 27 June 2025. The mission included discussions on the ongoing E&S activities, site visits to NNP1 operational areas, PHX Village, and the watershed area, as well as aquatic invertebrate sampling by the IMA. Positive feedback was received following the mission, and the full report is expected to be shared with NNP1PC around December 2025.





The six-month environmental and social monitoring mission by the IMA from 17-19 June 2025

2.7 WASTE MANAGEMENT AT THE OPERATION SITES

2.7.1 Waste Management at NNP1 Project Sites

In Q2 2025, a total of 15.24 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, a decrease of 3.51 m^3 compared with Q1 2025. The local contractor maintained routine waste collection and NNP1 landfill management throughout Q2 2025.

The amount of recyclable waste managed on site during Q2 2025 is shown in **Table 2.7-1.**

TABLE 2.7-1: AMOUNTS OF RECYCLABLE WASTE DURING Q2 2025

Source and Type of Recyclables		Unit	Carried Over from Q1 2025	Status in Q2 2025			
				Additions	Total (A)	Sold (B)	Remaining Amount (A - B)
Construction activity							
1	Scrap metal	kg	0	0	0	0	0
Sub-Total 1		**kg**	**0**	**0**	**0**	**0**	**0**
Operation camp							
2	Plastic bottle	kg	31	66	97	81	**16**
3	Aluminium Can	kg	N/A*	N/A	N/A*	N/A	**N/A**
4	Paper/Cardboard	kg	34	64	98	92	**6**
5	Glass	kg	144	81	225	0	**225**
6	Scrap metal	Kg	0	0	0	0	**0**
Sub-Total 2		**kg**	**209**	**211**	**420**	**173**	**247**
Grand Total (Sub-Total 1+2)		**kg**	**209**	**211**	**420**	**173**	**247**

*****Please note that aluminium cans are collected and sold separately by housekeepers before storage so there is no accurate recorded quantity. The item is therefore marked Not-available (N/A).

2.7.2 Hazardous Waste Management

The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q2 2025 are shown in **TABLE 2.7-2.**

TABLE 2.7-2: HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q2 2025

No.	Type of Hazardous Material	Unit	Total in Q2 2025	Used/ Disposed	Remaining
1	Diesel	Litre	17,324	15,480	1,844
2	Gasoline	Litre	2,986	2,365	621
3	Lubricant (Turbine oil)	Litre	31	0	31
4	Colour paint	Litre	39	1	38
5	Thinner	Litre	1	0	1
6	Grease oil	Litre	749	4	745
7	Gear Oil	Litre	86	9	77
8	Chlorine Liquid	Litre	250	75	175
9	HA Cut AF	Litre	3,925	0	3,925
10	HA Cut Cat AF	Litre	373	0	373
	Type of Hazardous Waste				
11	Used Oil (Hydraulic + Engine)	Litre	335.3	0	335.3
12	Used oil mixed with water	Litre	0	0	0
13	Empty used oil drum/container (drum 200L)	Unit	53	0	53
14	Use Oil Filter	Unit	31	0	31
15	Contaminated soil, sawdust and textile material	m^3	1.2	0	1.2
16	Used tyre	Drum	5	0	5
17	Empty used chemical drum/container (drum 20L)	Unit	153	0	153
18	Lead acid batteries	Unit	6	0	6
19	Empty paint and spray cans	Can	161	0	161
20	Halogen/fluorescent bulbs	Unit	560	0	560
21	Empty cartridge (Ink)	Piece	136	0	136
22	Clinic Waste	Kg	8	0	8
23	Expired Chlorine Powder	Kg	65	0	65

2.7.3 Animal Fodder (Pig Feed) Collection Programme

During Q2 2025, local villagers collected **385 kg** of food waste from the Owner's Site Office and Village (OSOV1's canteen) for feeding their animals. Additionally, food waste management was conducted by the new canteen service provider FTS (Fortune Service) routinely.



As part of the company's effort to reduce food waste at the canteen, aiming to maximize resource use and minimize disposal at the project landfill. EMO's waste management team interviewed the new canteen service provider and ADM on 13 February 2025 to identify the causes of increased food waste. The key factors identified were:

- The new provider, operating since January 2025, is still adjusting meal preparation to match actual staff demand.
- According to ADM, around 40% of staff did not pre-book meals in January and February 2025, resulting in unplanned walk-ins. This uncertainty led the canteen operator to prepare extra meals, increasing food waste.
- To address food waste, EMO issued an internal notice on 19 February 2025 urging staff to pre-book meals. Food waste from the canteen is routinely monitored, and Q2 meal bookings increased compared to Q1 2025. This slightly helped to reduce food waste generation in Q2 2025, as shown in **Table 2.7-3**.

Table 2.7-3: Food waste generated in the canteen

Month	Pre-book meals (A)	Walk in for meals (B)	Total Food waste generation (kg) (C)	Food waste for Villagers (kg) (D)	Food waste disposed of at the project Landfill (C) - (D)
Jan 2025	2,047	878	1002.2	192	810.2
Feb 2025	2,657	801	946	210.5	735.5
Mar 2025	2,556	788	913	167	746
April 2025	3,184	939	**717**	**128**	**589**
May 2025	3,110	829	**903**	**170**	**733**
June 2025	3,027	868	**541**	**87**	**454**

2.7.4 Community Solid Waste Management and Recycling Programme

NNP1-EMO has collaborated with Bolikhan EMU on the handover of the Houay Soup Landfill and community waste management. It was agreed that villagers from Thahuea, Hat Gniun, and Phouhomxay could use NNP1PC's landfill, with NNP1PC committing to repair the Houay Soup landfill for shared use once NNP1PC's landfill is full. This agreement was reported to the Department of Natural Resources and Environment Inspection, Ministry of Natural Resources and Environment (DNREI-MONRE), which raised no objections. Both EMU and EMO will continue to guide communities on proper waste disposal at the NNP1PC landfill.

On 27 Feb 2025, the EMO-EC&WM team held a community consultation meeting with representatives from 3 villages regarding the shared use of the NNP1PC landfill. Key messages on the Landfill operation schedule and waste handling procedures were communicated. This is to ensure proper waste separation by the villagers prior to disposing of the waste at the landfill.

- **Landfill Operational Schedule:**
  - Open three times a week (Mon, Wed, Fri) from 08:00 to 16:00
  - Managed by a local waste collection contractor
  - Contact numbers for inquiries: Tel: 020 76249274 and 020 99888747
- **Waste Handling Procedures:**
  - Detailed explanation provided on waste separation, storage, and transfer to the landfill.



Phouhomxay Village



Hat Gnuin Village



Thaheua Village

2.8 RESERVOIR OPERATIONS

2.8.1 Main Reservoir

The water level in and inflow to the main reservoir since January 2024 are displayed in the graphs in **Figure 2.8-1** and **Figure 2.8-2**.

During Q2 2025, the mean daily inflow to the main reservoir was 100 m^3/s. The minimum daily inflow was 36 m^3/s, maximum daily inflow was recorded at 444 m^3/s, and 25th percentile of 54 m^3/s and 75th percentile of 119 m^3/s. As indicated in **Figure 2.8-1,** the inflow during Q2 2025 was higher compared to the same period in 2024.

The water level in the main reservoir decreased with 6.92 m from El. 306.73 m asl (01 April 2025) to 299.81 m asl (19 June 2025) and then increased to 301.55 m asl (30 June 2025).

FIGURE 2.8-1: ***INFLOW TO THE MAIN RESERVOIR***

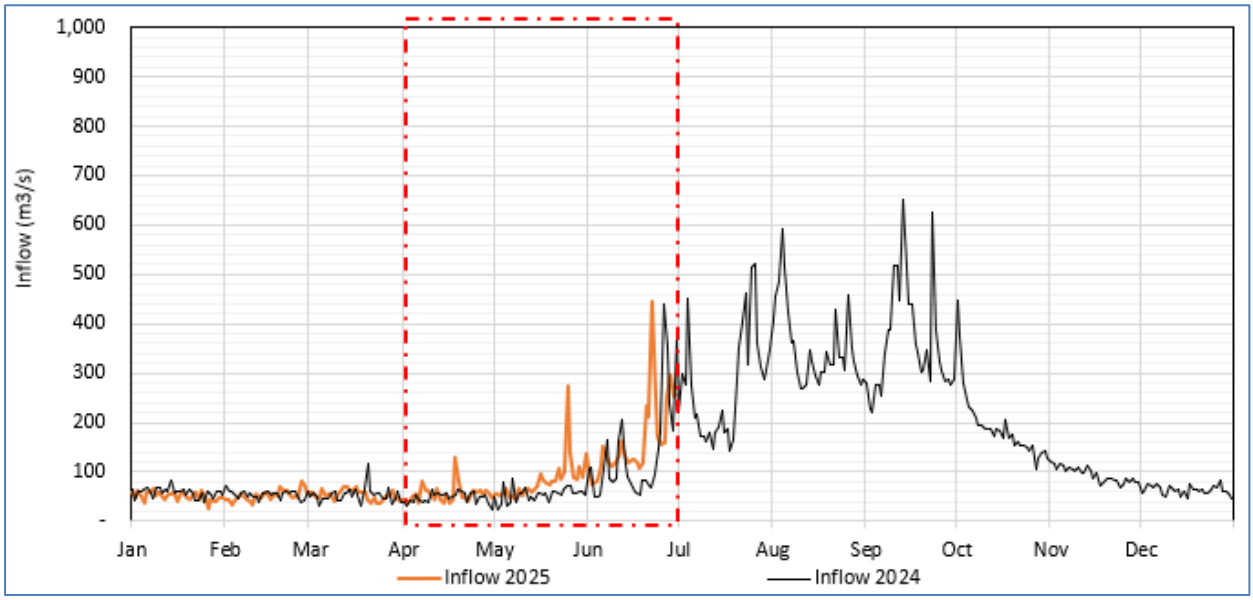
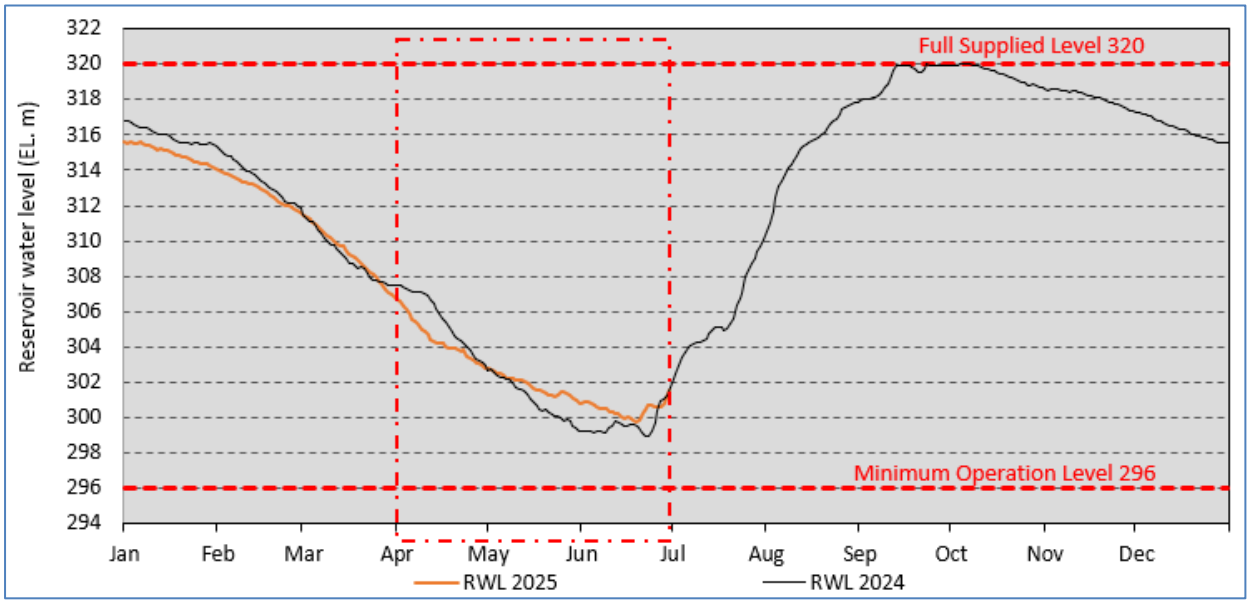


FIGURE 2.8-2: ***WATER LEVEL OF THE MAIN RESERVOIR***



2.8.2 Environmental Flow Requirements for the Operation Phase

NNP1PC has monitored compliance with the Environmental Flow Requirements (EFRs) stipulated in the CA, Annex C, Clause 53 (g) and as further modified in the Environmental Flow Assessment Report of July 2014 approved by MONRE. The EFRs have been monitored in accordance with the monitoring programme outlined in the ESMMP-OP 2019 (Vol. II, Part 2 on Subplan 1 on Reservoir and River Health Management), except with respect to thalweg water depth monitoring.

The results of the EFR compliance monitoring during Q2 2025 are summarized in **Table 2.8-1**.

TABLE 2.8-1: *SUMMARY OF EFRS COMPLIANCE MONITORING IN Q2 2025*

No	EFRs in the Downstream of the Re-regulation dam	EFRs compliance
1	Min flow 27 m^3/s at all times	100% of observations comply
2	Thalweg water depth at least 0.5 m in the entire reach from immediately downstream of the Re-regulation dam until 4.3 km downstream the dam (measured at cross-sections where visual observations or boat navigation indicate shallow waters)	The Q2 2025 monthly thalweg monitoring missions included monitoring of navigation difficulties. However, in May 2025 water depth measurements were also carried out due to discharge from the re-regulation dam below 30 m^3/s. In May 2025, there were two points (RWD05 and RWD06) that did not comply with the thalweg water depth standard but there was no boat navigation difficulty. The results of previous monitoring missions, as also confirmed by the LTA, have documented that when the discharge is 30 m^3/s or greater, the water depth requirements are met and there are no problems with navigating the river. Furthermore, in Q4 2024, at the beginning of the dry season, to gather and assess any complaints about boat navigation difficulties NNP1PC conducted interviews with inhabitants who use boats. There were no complaints from inhabitants, and no damages have been reported or observed. NNP1PC has consulted with the Environmental and social specialist who recommended that revisions to the monitoring programme should be made as part of ESMMP-OP update which will be commenced from Q4 2024 to Q3 2025.
3	Maximum rate of change (both rise and fall, separately) in stage of 0.6 m per hour	Four instances of non-compliance with the hourly rate of change caused by rapid drawdown to allow riverbed excavation activity at downstream of Main Powerhouse. To mitigate potential risks, TD, in coordination with ESD, issued an advance notification via WhatsApp to all downstream villages, the water supply operator, and relevant local government offices.
4	Maximum fluctuation in stage of 1.7 m over 24-hour (this requirement is about range and determines the maximum difference in stage height over 24-hour periods)	One instance of non-compliance due to 24 hourly water level fluctuations caused by rapid drawdown to allow riverbed excavation activity at downstream of Main Powerhouse.

No	EFRs in the Downstream of the Re-regulation dam	EFRs compliance
		An advance notification via WhatsApp was sent to all downstream villages, the water supply operator, and relevant local government offices.
5	Maximum fluctuation in stage of 1.7 m over 7-days (this requirement is about range and determines the maximum difference in stage height over 7-day periods)	One instance of non-compliance due to 7 days water level fluctuations caused by rapid drawdown to allow riverbed excavation activity at downstream of Main Powerhouse. An advance notification via WhatsApp to all downstream villages, the water supply operator, and relevant local government offices.

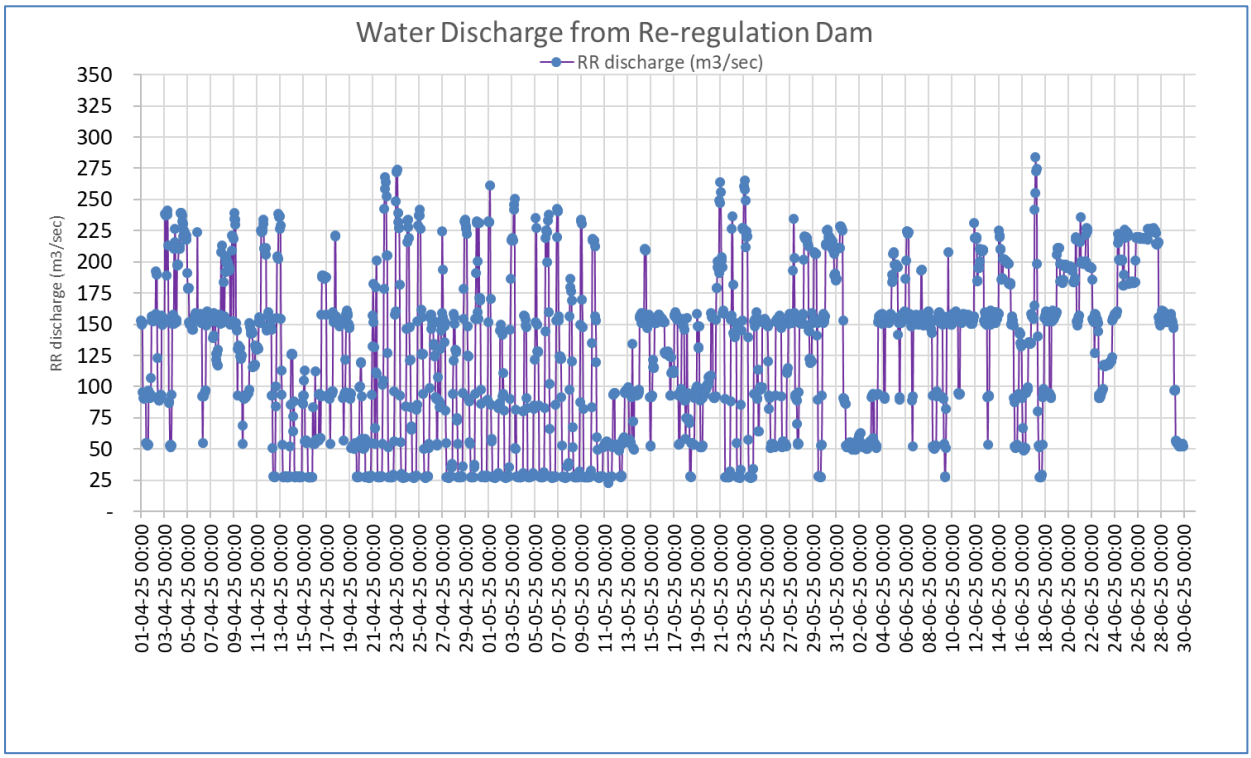
2.8.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q2 2025 indicates that the minimum flow requirement of 27 m^3/s has been met at all times. The Re-regulation Dam discharge graph can be found in **Figure 2.8-3.**

During Q2 2025, the mean discharge from the re-regulation dam was about 116 m^3/s in April 2025 and about 107 m^3/s and 148 m^3/s in May and June 2025 respectively.

The changes in the discharge from the re-regulation dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems. There were no complaints related to the flow discharges or fluctuation levels downstream the Re-regulation dam during the reporting period.

FIGURE 2.8-3: *DISCHARGE FROM THE RE-REGULATION DAM DURING Q2 2025*



2.8.2.2 Minimum Water Depth

Since 18 July 2018, NNP1PC has carried out weekly monitoring of river depths at 19 locations downstream the re-regulation dam as shown on **Figure 2.8-4.** These locations represent cross-sections with possible shallow water depths at low discharge rates.

The monitoring is undertaken to confirm compliance with the water depth requirements in the Concession Agreement, Annex C, and the approved Environmental Flow Assessment (Thalweg water depth at least 0.5 m in the entire reach from immediately downstream of the Re-regulation dam until 4.3 km downstream the re-regulation dam).

Starting in December 2020, the water depths have been measured across the river channel where visual observations or boat navigation indicate shallow waters to ensure that the measurements represent the river thalweg.

According to the recommendations by the Lenders' Technical Advisor (LTA) during the virtual site visit on 21 to 26 November 2021, NNP1PC has continued to monitor the situation at the critical sites under conditions with discharge of less than 30 m^3/s for detecting any navigation problems and also monitor whether any complaints have been raised to consider how to solve the problems, if any. The results of these monitoring missions have documented that when the discharge is 30 m^3/s or greater, the water depth requirements are met and there are no problems with navigating the river.

NNP1PC carried out three boat monitoring missions in Q2 2025. Only one mission (May 2025) when the discharge was about 27 m^3/s included thalweg water depth measurements. A total of 19 points were measured. The results show that the thalweg water depths at Km 5.66 (RWD05) and Km 6.16 (RWD06) downstream of Re-regulation Dam were 0.3 m and 0.4 m respectively thus not complying with the thalweg water depth requirement, however, there were no boat navigation difficulties during the missions.

NNP1PC has consulted with the Environmental and social specialist who recommended that revisions to the monitoring programme should be made as part of ESMMP-OP update which will be commenced from Q4 2024 to Q3 2025.

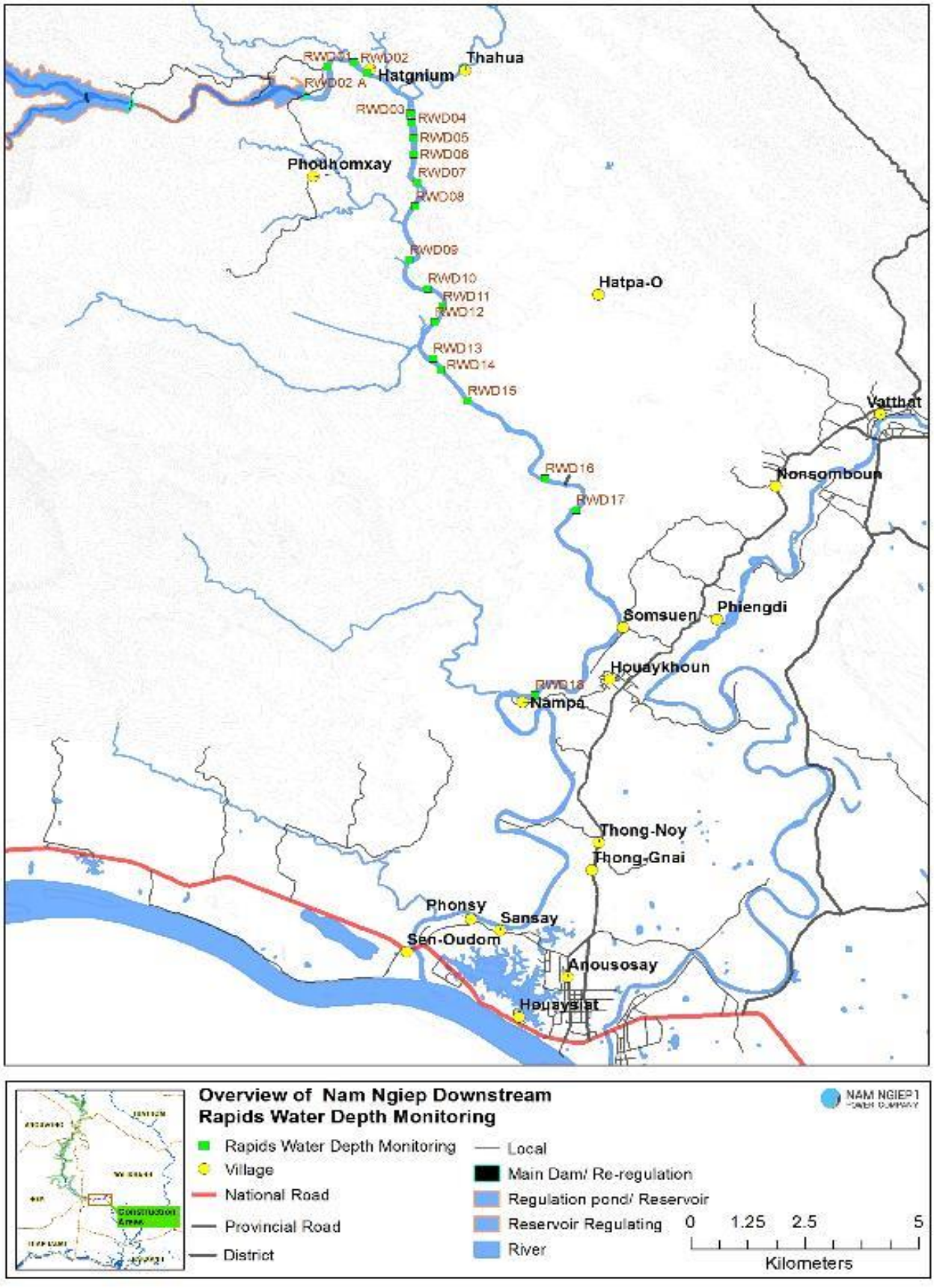


FIGURE 2.8-4: ***LOCATION MAP OF RIVER DEPTH MONITORING POINTS***

2.8.2.3 Stage Height Fluctuations

The requirements on stage height fluctuations constitute a rise or a fall in water elevation and include two aspects:

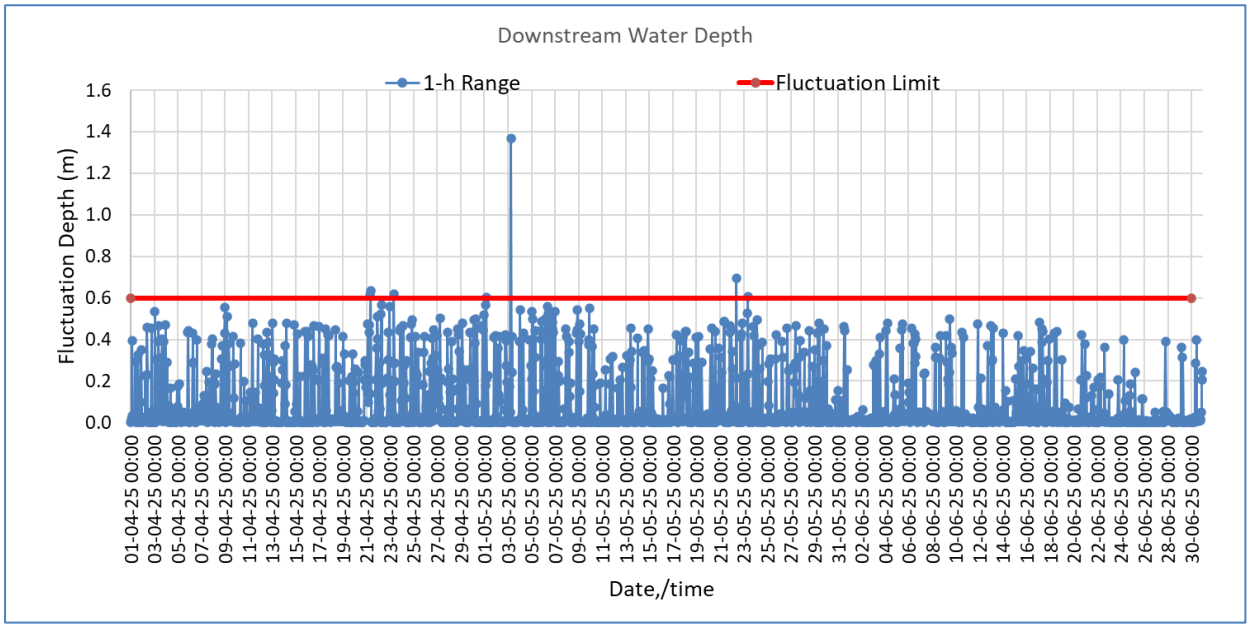
1. A requirement on the rate of change which is set at a maximum of 0.6 m per hour (calculated from the hourly water level recordings).
2. Requirements on the range in fluctuations over 24-hour periods and 7-day periods respectively, which is set at a maximum of 1.7 m for both periods. In other words, the range requirements determine the maximum difference in stage height over 24-hour periods and 7-day periods respectively.

Compliance with the 24-hour maximum fluctuation EFR is determined by calculating the difference between the maximum and the minimum stage height over each 24-hour period. In the same way, the 7-day maximum fluctuation EFR, is determined by calculating the difference between the maximum and the minimum stage height over each 7-day period. There is no compulsion for the Company to meet the stage height fluctuation requirements after a high flow event passes over the Re-regulation dam spillway.

In practice, meeting stage height fluctuation EFRs are managed through controlling the rate of change in discharge from the re-regulation dam/powerhouse. This is done using established rating relationships between stage height and discharge, as set out in the Re-regulation dam operation manual. These relationships are regularly checked and revised as necessary, as they would change whenever the channel morphology changes due to significant erosion or deposition.

During Q2 2025, the maximum allowed rate of change of 0.6 m over 1-hour was complied with for all hourly periods, except on 21 April, 23 April, 03 May and 23 May 2025 where there were four instances of exceedance attributed to downstream water level fluctuations resulting from riverbed excavation downstream of Main Powerhouse in the upper section of regulation reservoir) . The primary purpose was to reduce the tailrace water level closer to the design specification. Bedrock excavation was excavated to achieve full hydraulic efficiency. This could improve turbine performance and energy output. An advance notification via WhatsApp to all downstream villages, the water supply operator, and relevant local government offices. As of now, no complaints have been received, and no damage has been observed. The results are presented in **Figure 2.8-5**.

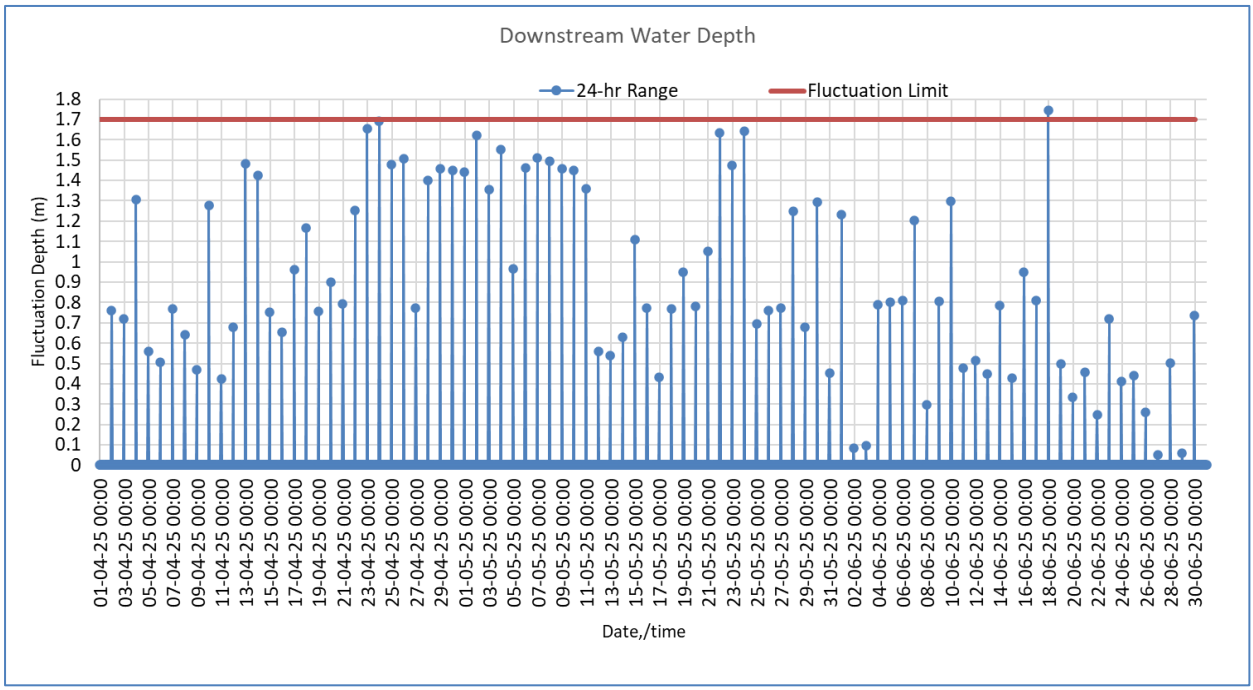
FIGURE 2.8-5: *HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q2 2025*



During Q2 2025, the maximum allowed difference in stage height of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:59), except on 17 June 2025 where there was one instance of exceedance due to water level fluctuations caused by rapid drawdown to allow riverbed excavation activity at downstream of Main Powerhouse. As of now, no complaints have been received, and no damages have been reported or observed.

The results of the monitoring are presented in **Figure 2.8-6.**

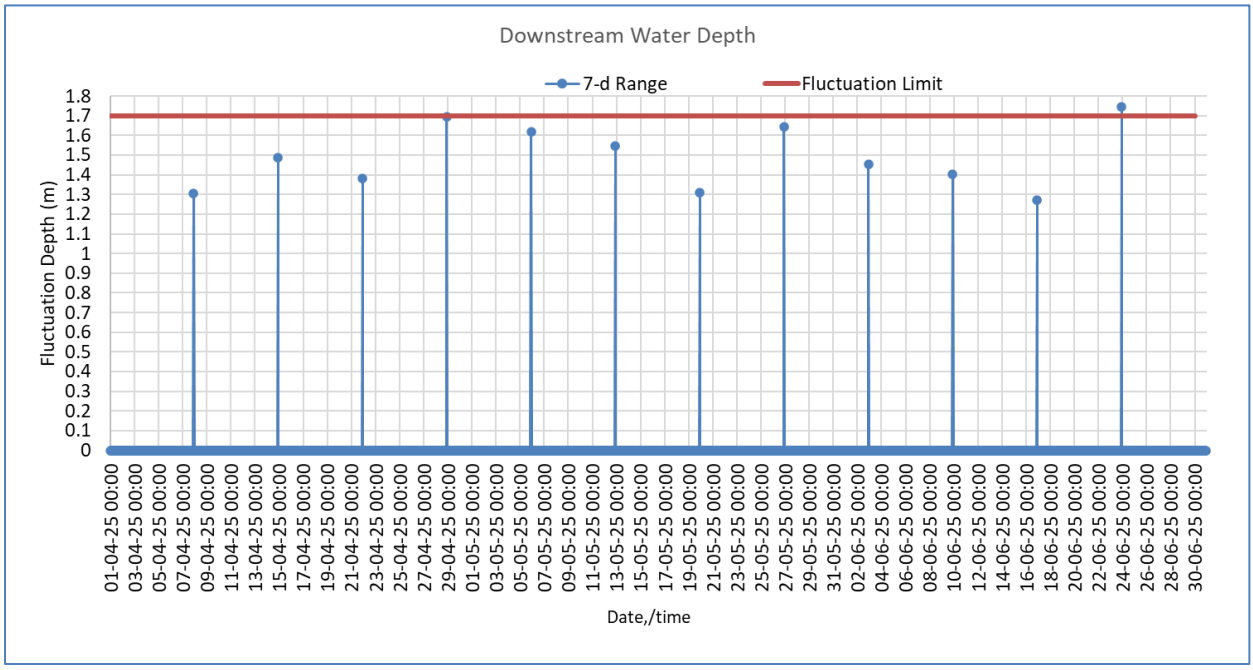
FIGURE 2.8-6: *24-HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q2 2025*



During Q2 2025, the maximum difference in stage height of 1.7 m over 7-days was complied with for all 7-day periods, except on 23 June 2025 where there was one instance of exceedance due to water level fluctuations caused by rapid drawdown to allow riverbed excavation activity at

downstream of Main Powerhouse. As of now, no complaints have been received, and no damage has been observed. The results are presented in **Figure 2.8-7**.

FIGURE 2.8-7: *7-DAY STAGE HEIGHT DIFFERENCE (M) DURING Q2 2025*



2.9 WATER QUALITY MONITORING

2.9.1 Surface Water (River) and Depth Profile Water Quality

Descriptions of each monitoring station, surface water and depth profile water quality monitoring parameters, and the location of sampling map can be found in **Appendix 3** and all surface water quality data for Q2 2025 are listed in **Appendix 5-1.**

Dissolved Oxygen (DO)

The results of DO measurements for the station immediately upstream of the main dam (R05 – intake at 276 m asl.) and immediately downstream of the re-regulation dam (NNG05) are presented in **Figure 2.9-1,** the DO long profile measurement as timeseries are presented in **Figure 2.9-2,** and the full set of DO surface water quality data are shown in **Table 2.9-1**.

The water temperature and DO depth profiles in the main reservoir at R05 during Q2 2024, Q1 2025 and Q2 2025 are presented in **Figure 2.9-4** to **Figure 2.9-6.**

FIGURE 2.9-1: ***DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE MAIN DAM***

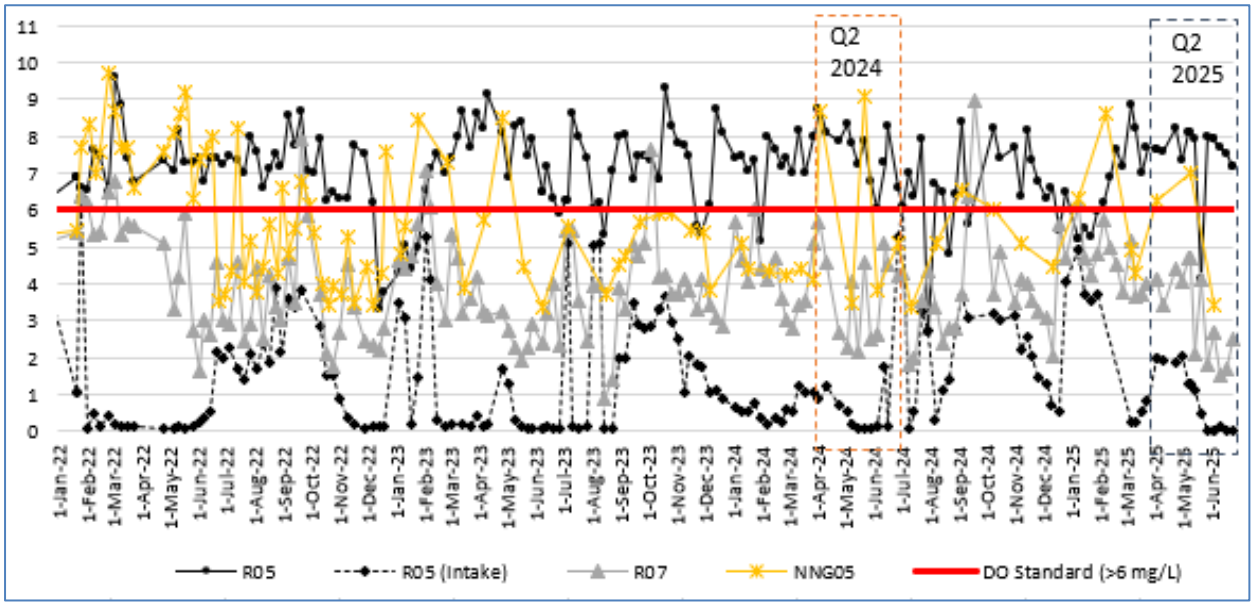
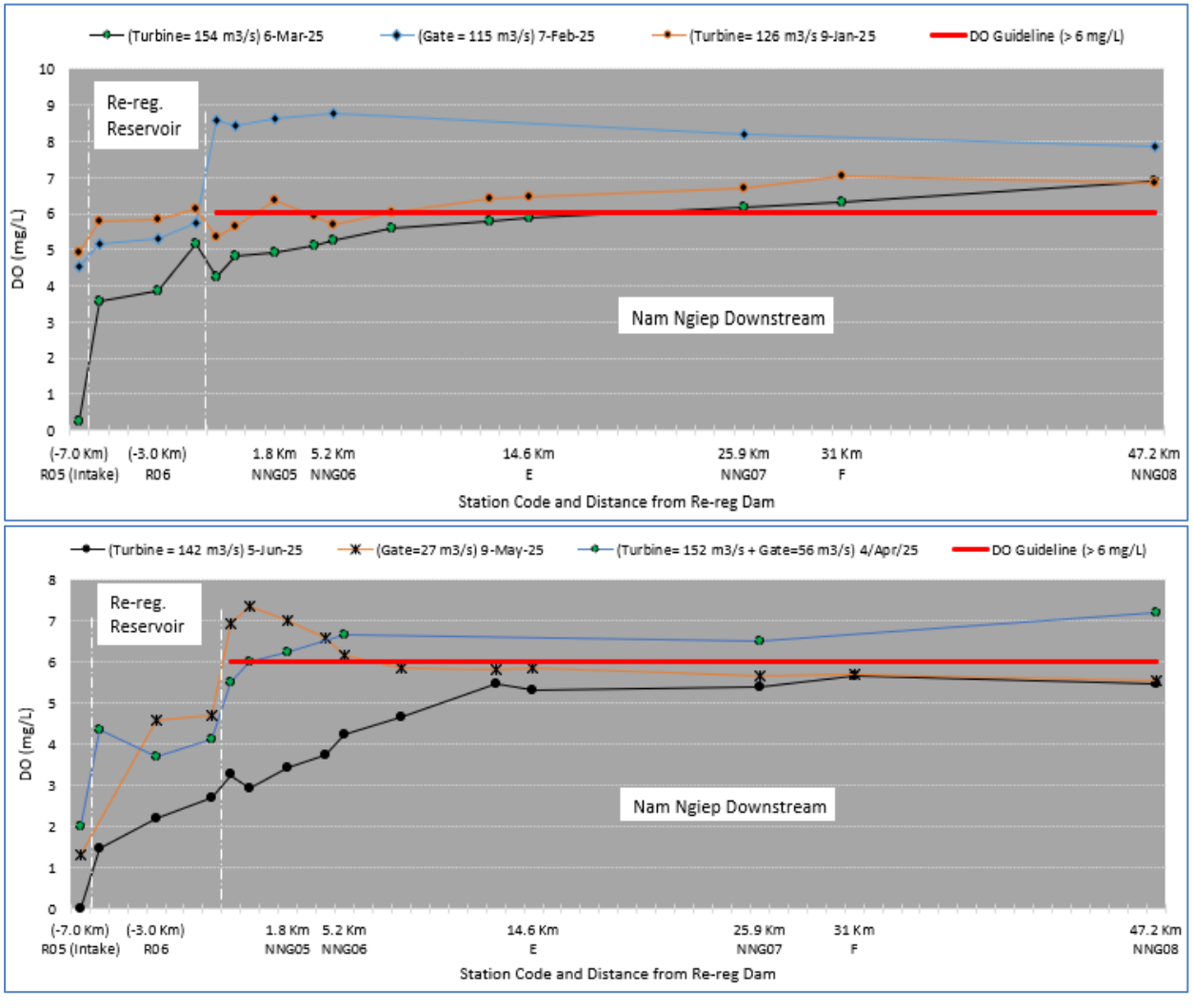


FIGURE 2.9-2: ***DISSOLVED OXYGEN LONG PROFILE MEASUREMENT FROM IMMEDIATELY UPSTREAM THE MAIN DAM TO LOWER NAM NGIEP (Q1 2025 AND Q2 2025)***



Main Reservoir

Figure 2.9-6 and **Figure 2.9-7** present the DO and water temperature depth profile timeseries in the Main Reservoir (R04 and R05) from September 2018 to June 2025, the graphs clearly show seasonal variations in water temperatures and a deepening of the thermocline during periods with cooler water leading to a corresponding deepening of the oxycline.

The depth profile monitoring during Q2 2025 indicates formation of thermoclines and oxyclines in the main reservoir at the monitored stations at different depths.

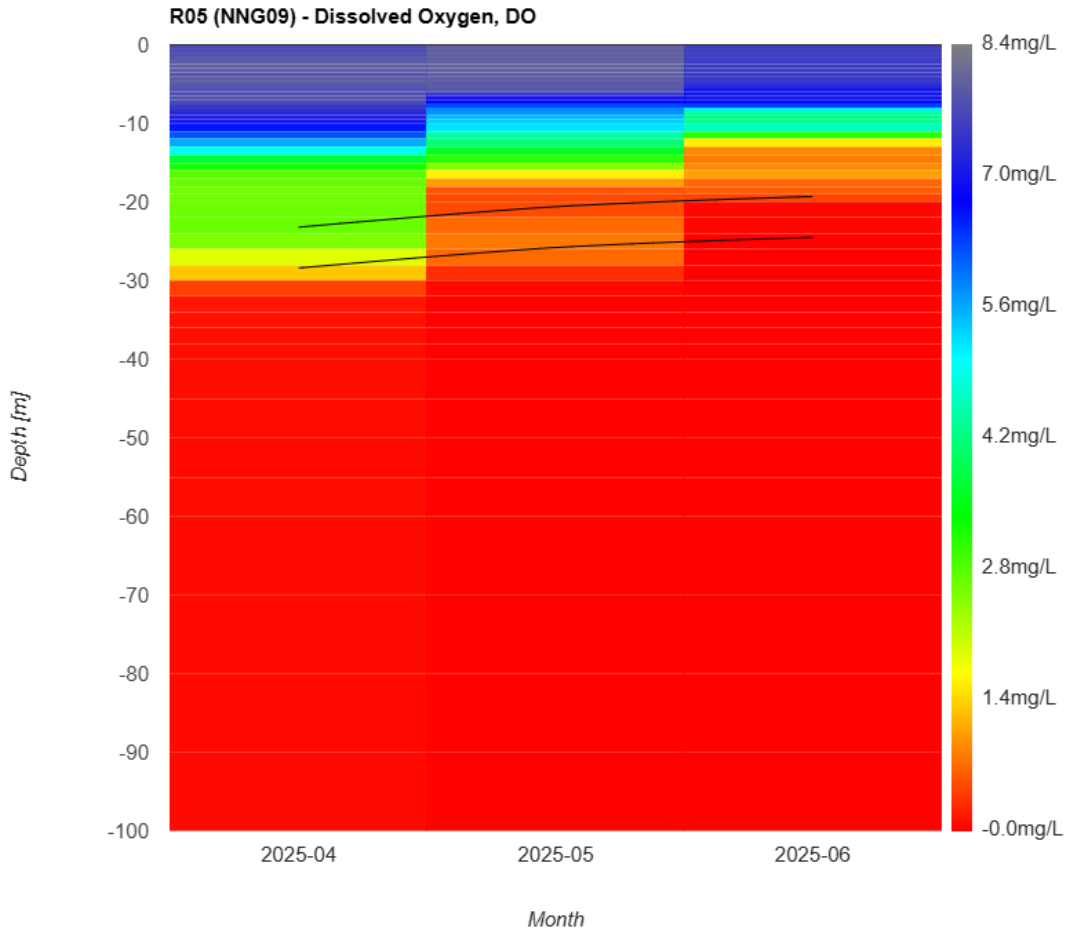
At R05, when comparing Q2 2025 with Q2 2024, the thermocline and oxycline show similar patterns.

Figure 2.9-5 shows the mean DO and water temperature depth profiles for Q2 2024, Q1 2025 and Q2 2025 at R05. The profiles for Q1 2025 and Q2 2025 show increasing water temperatures, formation of an oxycline occurred at depths between 6.5 m and 15 m. The profiles for Q2 2025 indicate that oxygen depletion (about 2 mg/L DO) is found at about 28 m below surface in April 2025 gradually decreasing to a depth of about 13 m in June 2025. Compared to Q2 2024, there are no obvious improvements in the DO levels.

The monthly mean DO concentration at the intake level decreased from 1.96 mg/L in April 2025, to 0.72 mg/L in May 2025 and 0.04 mg/L in June 2025. Anoxic levels were found at decreasing depths from about 32 m in April 2025 (about 2 m below the intake sill) to 30 m in May 2025 (about 2 m below the intake sill) and to a depth of about 20 m in June 2025 (at the intake sill), with a peak in DO of 2 mg/L to 3 mg/L at about 26 m depth followed by a drop in DO down to anoxic levels at 32 m depth (about 2 m below the intake sill) (see **Figure 2.9-3**).

The DO concentrations at R04 showed a similar pattern to R05.

FIGURE 2.9-3 MONTHLY MEAN CONCENTRATIONS OF DISSOLVED OXYGEN IN R05



At R03, during Q2 2025, DO concentrations varied between 2.8 mg/L and 9.5 mg/L with an average of 8.0 mg/L in the upper 6.0 m and at depths from 6.5 m to about 50 m below surface the DO varied between 0.01 mg/L and 8.5 mg/L. Anoxic conditions were found at depths from 13 m to bottom in April 2025, at depths from 15 m to bottom in May 2025 and at depths from 24 m to bottom in June 2025.

At R02, during Q1 2025, DO concentrations varied between 2.8 mg/L and 9.4 mg/L with an average of 6.5 mg/L in the upper 6.0 m and at depths from 6.5 m to about 24 m below surface the DO varied between 0.6 mg/L and 6.4 mg/L. There were no anoxic conditions during Q2 2025.

At R01, the mean DO concentration throughout the quarter was about 7.7 mg/L over the entire water column with no measurements below 6.2 mg/L.

Re-regulation Reservoir (R06 and R07)

The depth profiles at R06 and R07 in the Re-regulation Reservoir showed no indications of a thermocline, because the Re-regulation Reservoir behaves more like a river than a lake.

The mean monthly DO concentrations at R06 over the entire water column decreased from 3.4 mg/L in April, 2.0 mg/L in May to 1.7 mg/L in June 2025. A similar pattern was found at R07. The DO concentrations in R06 and R07 are likely linked to the DO concentrations at the intake level in the main reservoir. It should be noted that the actual flow patterns and movements of water from R05 to the intake is not known and is likely rather complex with circulation patterns or other complex water movements near the intake, which adds uncertainties to correlating water quality

data at or near the intake depth at R05 in the main reservoir with water quality data in the Re-regulation Reservoir.

Nam Ngiep Upstream and Tributaries

The Nam Ngiep Upstream station (NNG01), the station in Nam Chian (NCH01) a left bank tributary and the station in Nam Phouan (NPH01) a right bank tributary at the upper part of the reservoir had DO concentrations above 6 mg/L during Q2 2025.

Downstream Stations

During Q2 2025, a total of three monitoring missions were conducted. All three monitoring missions were undertaken during discharges greater than 27 m^3/s (complied with the minimum environmental flow requirement).

As indicated in **Figure 2.9-2**, during combined gate and turbine discharges in April 2025, the DO concentration in all Nam Ngiep downstream stations were above 6 mg/L and complied with the Standard. However, periods with only gate discharge (May 2025 – except first 5.2 km from the Re-regulation Dam) and turbine discharge (June 2025) resulted in DO concentrations varying between 2.9 mg/L and 5.8 mg/L in all downstream stations. Therefore, DO concentrations in May and June 2025 did not comply with the National Surface Water Quality Standard. Note that gate discharge during May 2025 sampling was just started one hour ahead of the mission.

No dead fish was observed in Nam Ngiep downstream during Q2 2025.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam.

FIGURE 2.9-4: ***MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q2 2025***

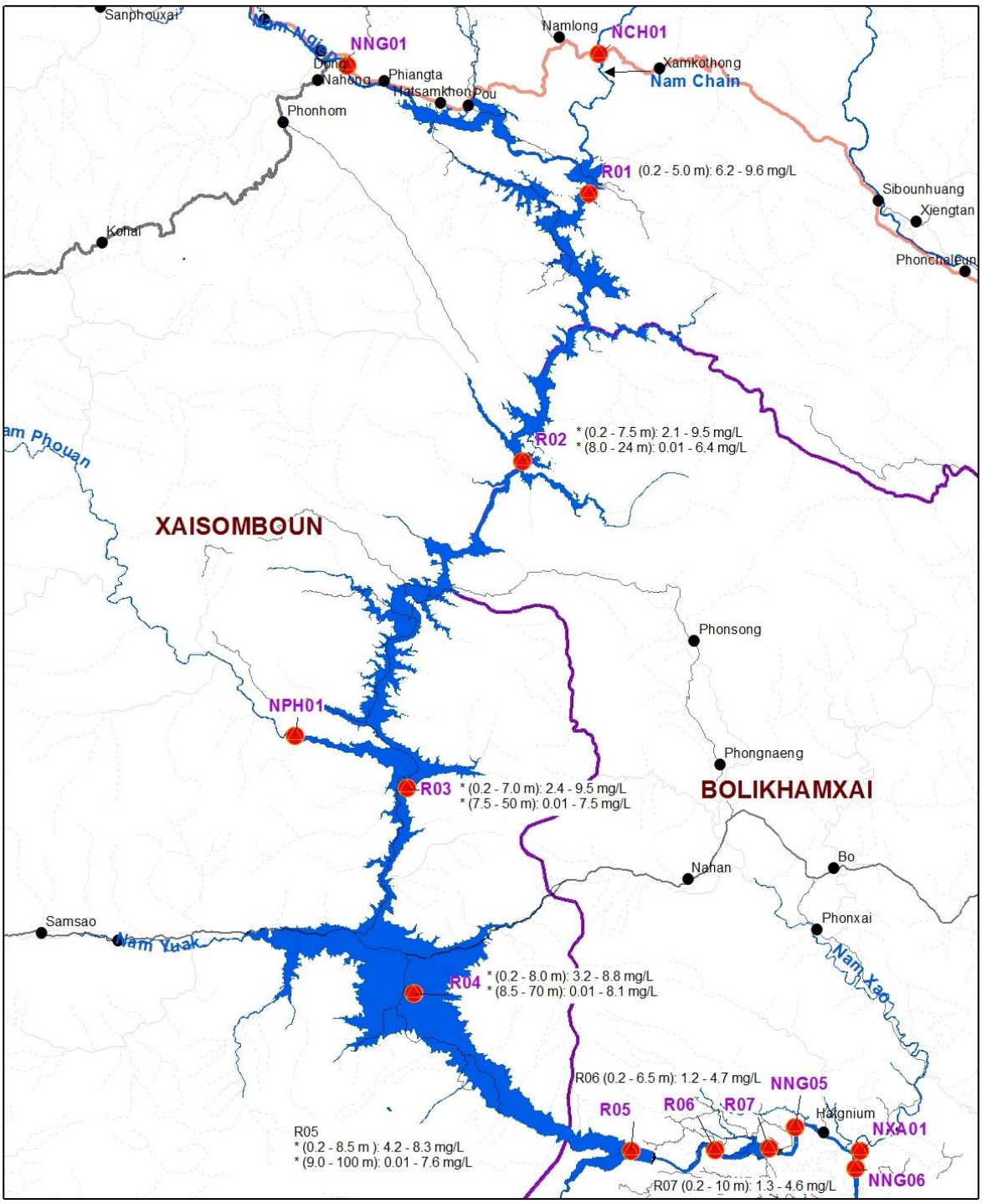


FIGURE 2.9-5: ***MEAN WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R05)***

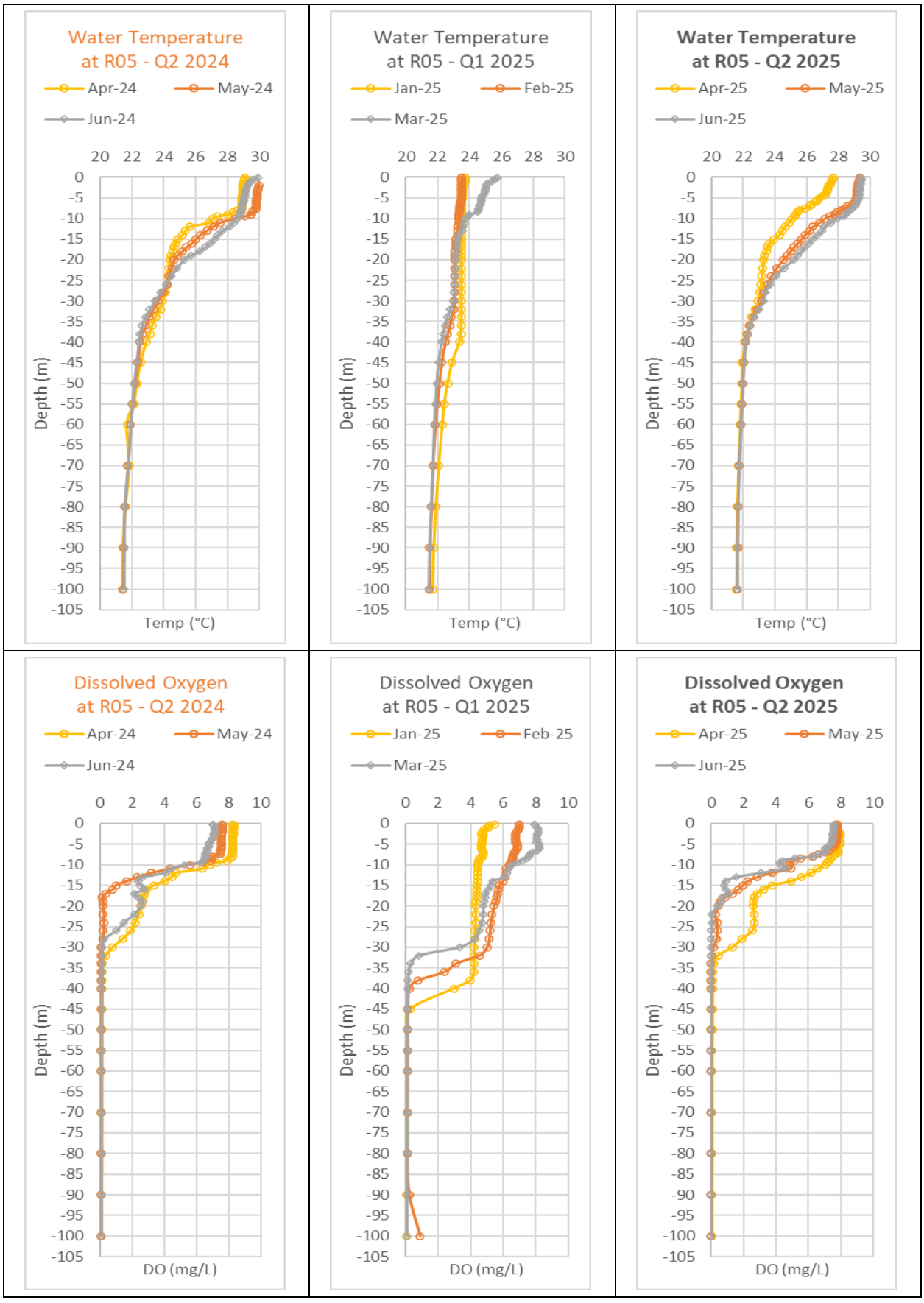


FIGURE 2.9-6: ***WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R04 - R05), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 – JUNE 2025***

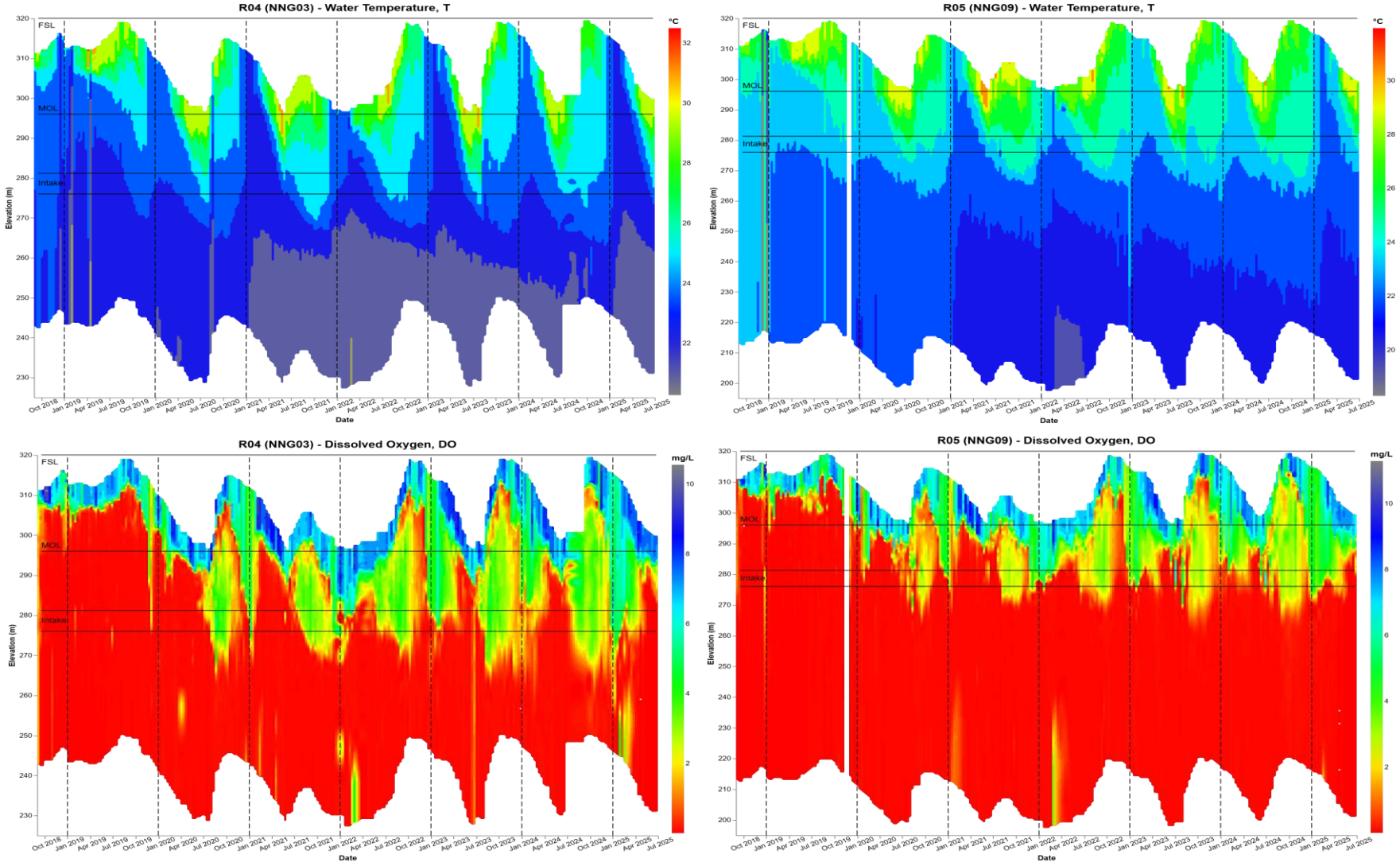


FIGURE 2.9-7: THE STRAIGHT-LINE GRAPH OF MONTHLY AVERAGED DO AND WATER TEMPERATURE AT R04 AND R05

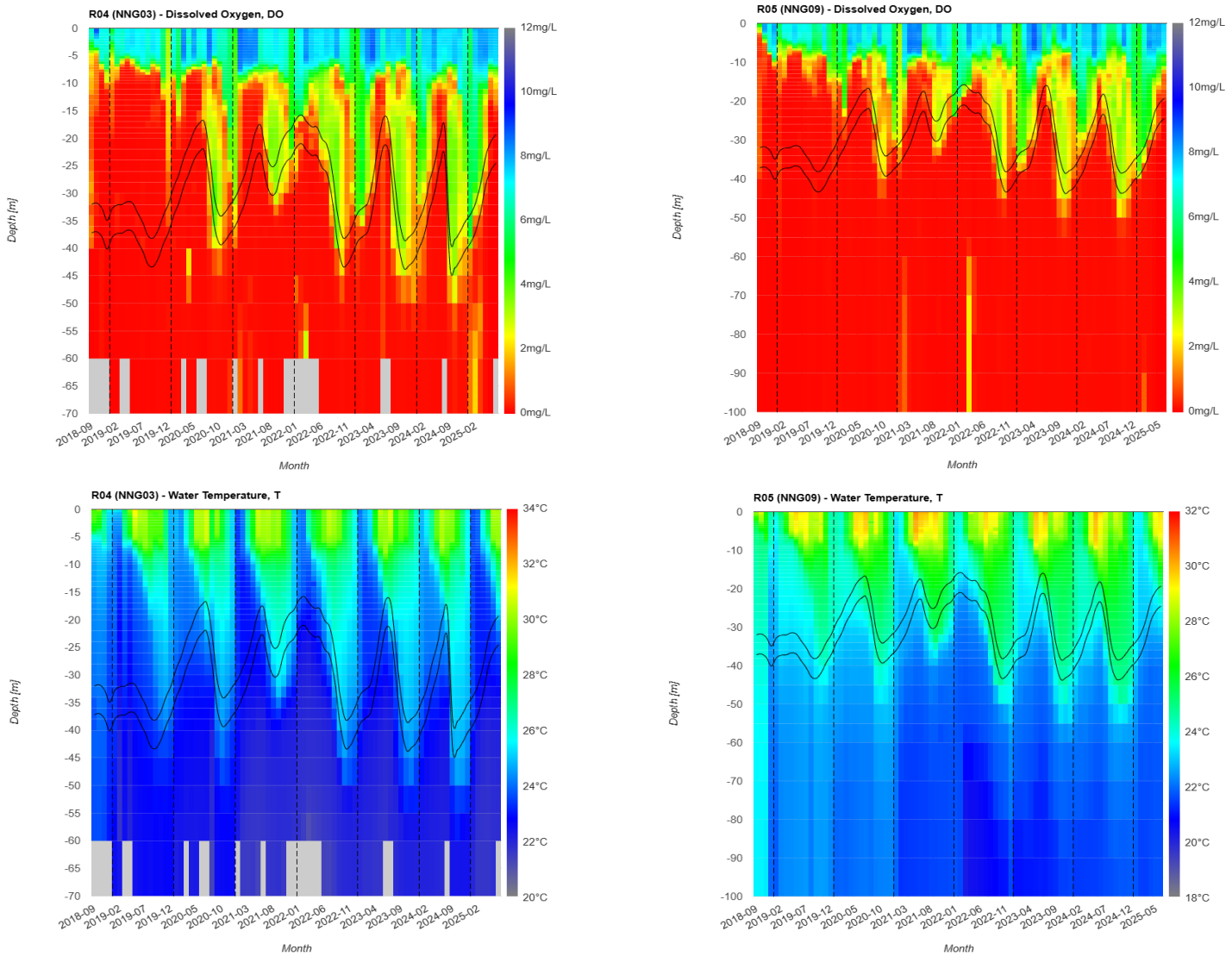


TABLE 2.9-1: ***DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, DO (MG/L) RESULTS OF R05 AT INTAKE DEPTH, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2025***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR DISSOLVED OXYGEN: ≥6 MG/L)

Station Code	NNG01	R01	R02	R03	R04	R05 Intake	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Apr-25	7.25													9.38			
2-Apr-25		8.44	9.05	9.34											9.39		
3-Apr-25					7.53	2.01	7.65	3.71	4.13								
4-Apr-25										6.24	6.65	6.53	7.21			8.03	6.83
9-Apr-25		6.88	8.02	8.83	8.72												
10-Apr-25						1.92	7.57	3.45	3.4								
22-Apr-25		6.98	8.18	8.08	8.14												
23-Apr-25						1.87	8.24	4.69	4.41								
29-Apr-25		7.75	7.98	8.27													
30-Apr-25					7.08	2.05	7.33	4.23	4.08								
6-May-25	8.75													9.42			
7-May-25		6.61	8	7.97											7.53		
8-May-25					7.71	1.3	8.1	4.6	4.7								
9-May-25										7.0	6.18	5.65	5.55			5.59	5.5
13-May-25		7.07	7.5	7.93	7.66												
14-May-25						1.1	7.9	1.8	2.1								
20-May-25		6.79	8.06	8.33	7.65												

Station Code	NNG01	R01	R02	R03	R04	R05 Intake	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
21-May-25						0.5	4.1	4.1	4.1								
27-May-25		6.68	8	8.24	7.94												
28-May-25						0.01	8	1.4	1.8								
3-Jun-25		7.02	8.2	7.92											7.49		
4-Jun-25					7.57	0.01	7.9	2.2	2.7								
5-Jun-25										3.43	4.25	5.41	5.49			6.85	6.63
10-Jun-25	6.84													7.97			
11-Jun-25		6.23	7.7	8.53	7.72												
12-Jun-25						0.12	7.7	1.3	1.5								
17-Jun-25		6.49	8.4	8.48	7.74												
18-Jun-25						0.01	7.5	1.4	1.7								
24-Jun-25			7.8	8.09	7.82												
25-Jun-25						0.01	7.2	2	2.5								

Ammonia Nitrogen

In Q2 2025, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 2.9-2: ***AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2025***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR AMMONIA NITROGEN: <0.2 MG/L)

Station Code	NN G01	R01	R02	R03	R04	R05	R06	R07	NN G05	NN G06	NN G07	NN G08	NC H01	NP H01	NX A01	NHS 01
1-Apr-25	<0.1												<0.1			
2-Apr-25		<0.1		<0.1										<0.1		
3-Apr-25					<0.1	<0.1										
6-May-25	<0.1												<0.1			
7-May-25		<0.1		<0.1										<0.1		
8-May-25					<0.1	<0.1										
3-Jun-25		<0.1		<0.1										<0.1		
4-Jun-25					<0.1	<0.1										
10-Jun-25	<0.1												<0.1			

Biochemical Oxygen Demand (BOD_5)

Since 2014, the Biochemical Oxygen Demand (BOD_5) values in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L). The results for Q2 2025 indicate that the BOD_5 levels are compliant with the standard at all stations, except Nam Ngiep upstream (NNG01) and Nam Xao (NXA01) in June 2025.

In addition, NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam.

TABLE 2.9-3: *BOD_5 (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2025*

(NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD_5: <1.5 MG/L)

Station Code	NN G01	R01	R02	R03	R04	R05	R06	R07	NN G05	NN G06	NN G07	NN G08	NC H01	NPH 01	NXA 01	NHS 01
1-Apr-25	<1												<1			
2-Apr-25		<1		<1										<1		
2-Apr-25 Bottom				<1												
3-Apr-25					<1	<1	<1	<1								
3-Apr-25 Bottom					<1	<1										
4-Apr-25									<1	<1	<1	<1			<1	<1
6-May-25	<1												<1			
7-May-25		<1		<1										<1		
7-May-25 Bottom				<1												
8-May-25					<1	<1	<1	<1								
8-May-25 Bottom					<1	<1										
9-May-25									<1	<1	<1	<1			<1	<1
3-Jun-25		<1		<1										<1		
3-Jun-25 Bottom				<1												
4-Jun-25					<1	<1	<1	<1								
4-Jun-25 Bottom					4.7	<1										
5-Jun-25									<1	<1	<1	<1			1.83	1.13
10-Jun-25	2.61												<1			

Chemical Oxygen Demand (COD)

The COD measurements in Q2 2025 are presented in **Table 2.9-4**.

TABLE 2.9-4: ***COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2025 (NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)***

Station Code	NNG 01	R01	R02	R0 3	R0 4	R05	R06	R07	NNG 05	NNG0 6	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
1-Apr-25	18.5												14. 7			
2-Apr-25														12.2		
3-Apr-25							12.2	1.9			<5	<5			<5	<5
4-Apr-25									<5	<5	<5	<5			<5	<5
6-May-25	16.0												16. 0			
7-May-25														17.3		
8-May-25							13	8.3								
9-May-25									<5	12.2	<5	9.6			18.5	7.0
3-Jun-25																
4-Jun-25							8.96	7.7								
5-Jun-25									10.2	16.6	24.3	12.8			62.7	25.6
10-May-25	30.7												17. 9			

Faecal Coliform Bacteria

The results of the faecal coliform analyses in Q2 2025 are presented in **Table 2.9-5**.

During the Q2 2025, the surface water quality standard for Faecal coliform was complied with in all stations, except in NNG01 and NCH01 on 10 June 2025.

The data indicates that the concentrations of faecal coliform bacteria in the re-regulation reservoir (R06 and R07) and at R05 in the main reservoir are well below the surface water quality standard (and within typical standards for excellent inland bathing waters[1]).

TABLE 2.9-5: ***FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2025 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)***

Station Code	NNG0 1	R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	NN G05	NNG 06	NNG07	NNG0 8	NCH0 1	NPH 01	NXA 01	NHS 01
1-Apr-25	540												350			
2-Apr-25														11		
3-Apr-25						0	0	2								
4-Apr-25									8	7	17	33			22	2

[1] *E. Coli* < 500 cfu/100 mL, https://environment.data.gov.uk/bwq/profiles/help-understanding-data.html

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-May-25	920												920			
7-May-25														11		
8-May-25						8	0	11								
9-May-25									220	350	70	70			170	540
3-Jun-25														130		
4-Jun-25						0	17	49								
5-Jun-25									34	34	34	130			350	240
10-Jun-25	1,600												1,600			

Total Coliform Bacteria

The results of measurements for total coliform bacteria are presented in **Table 2.9-6.** The results indicate a similar pattern and same tendency as for faecal coliform bacteria. There were no exceedances of the National Surface Water Quality Standard (<5,000 MPN/100 mL) for total coliform bacteria.

TABLE 2.9-6: ***TOTAL COLIFORM (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2025 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)***

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Apr-25	920												540			
2-Apr-25														33		
3-Apr-25						0	5	5								
4-Apr-25									8	11	33	110			26	17
6-May-25	920												920			
7-May-25														39		
8-May-25						22	5	17								
9-May-25									1,600	1,600	170	350			540	1,600
3-Jun-25														1,600		
4-Jun-25						0	34	220								
5-Jun-25									280	920	1,600	920			1,600	1,600
10-Jun-25	1,600												280			

2.9.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q2 2025, including 02 camps (OSOV1 and OSOV2) and at the Wastewater Treatment System of the Main Powerhouse**.** The effluent monitoring location sites can be found in **Figure 2.9-8.**

The results are described in **Table 2.9-7** and the full data set is in **Appendix 5-2**.

The status of compliance as of 30 June 2025 can be summarized as follows:

- Non-compliance with total nitrogen for the wastewater treatment systems in the Main Powerhouse (EF19) and OSOV2 Camp (EF13);
- Non-compliance with total phosphorus, faecal coliform and total coliform at Main Powerhouse (EF19), OSOV1 (EF01) and OSOV2 (EF13).

FIGURE 2.9-8: ***LOCATION OF EFFLUENT MONITORING POINTS***

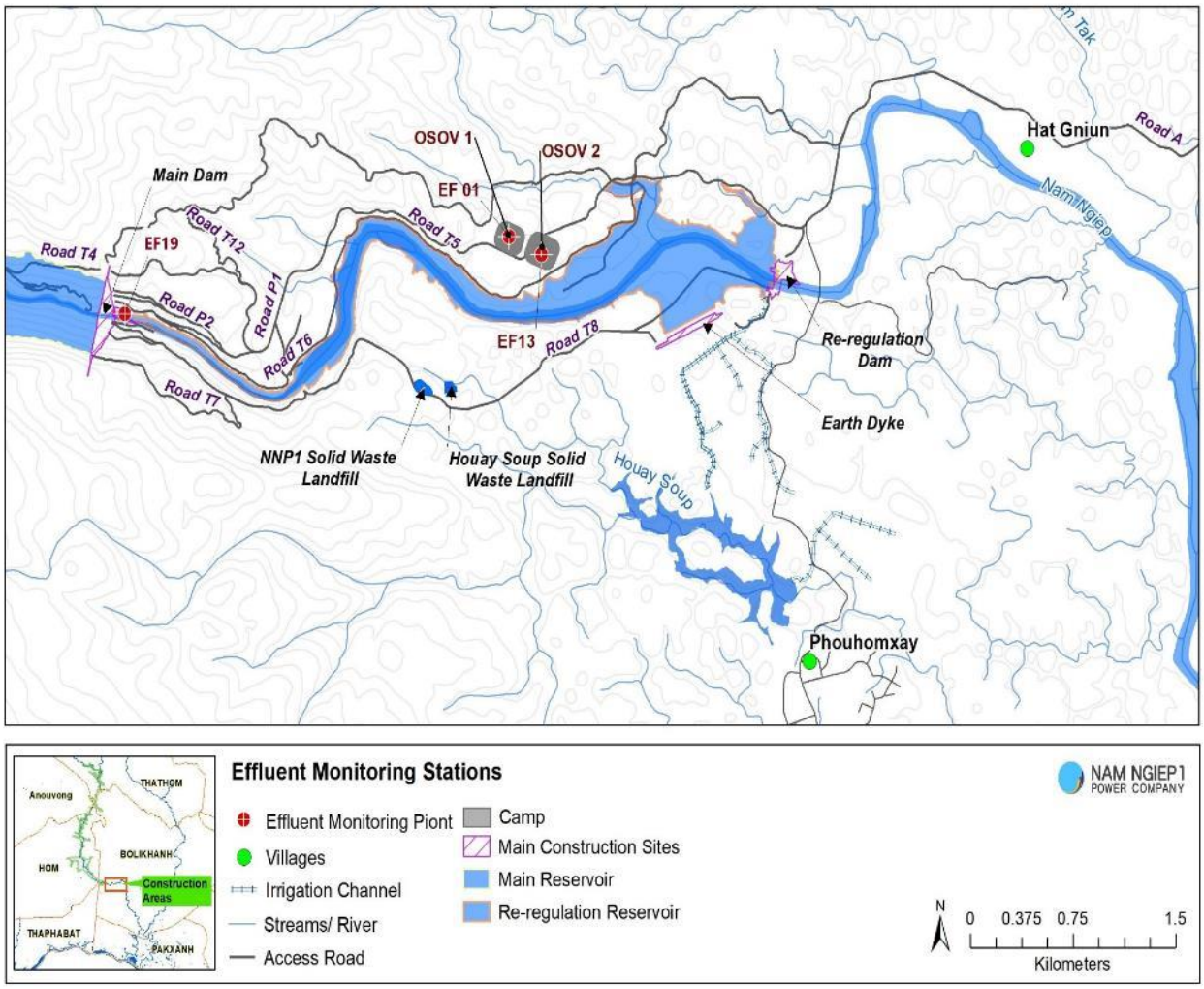


TABLE 2.9-7: *RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q2 2025 (NON-COMPLIANCE PARAMETERS ONLY)*

		Site Name	OSOV1	OSOV2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameters (Unit)	Guideline in the CA			
1-Apr-25	Total Nitrogen (mg/L)	<10.0	3.00	9.00	6.0
21-Apr-25	Total Nitrogen (mg/L)	<10.0	2.00	6.00	14.0
6-May-25	Total Nitrogen (mg/L)	<10.0	1.00	11.00	5.0
19-May-25	Total Nitrogen (mg/L)	<10.0	2.00	4.00	14.6
2-Jun-25	Total Nitrogen (mg/L)	<10.0	6.00	4.00	10.0
16-Jun-25	Total Nitrogen (mg/L)	<10.0	3.00	6.00	21.0
1-Apr-25	Total Phosphorus (mg/L)	<2	0.78	0.74	4.4
21-Apr-25	Total Phosphorus (mg/L)	<2	2.5	0.61	7.5
6-May-25	Total Phosphorus (mg/L)	<2	1.62	0.93	7.2
19-May-25	Total Phosphorus (mg/L)	<2	1.33	0.47	6.6
2-Jun-25	Total Phosphorus (mg/L)	<2	1.53	0.37	6.1
16-Jun-25	Total Phosphorus (mg/L)	<2	3.0	0.38	7.4
1-Apr-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	920
21-Apr-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
6-May-25	Total coliform (MPN/100 mL)	<400	5,400	54,000	0
19-May-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
2-Jun-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
16-Jun-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
1-Apr-25	Faecal Coliform (MPN/100 mL)	<400	920	1,600	540
21-Apr-25	Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	0
6-May-25	Faecal Coliform (MPN/100 mL)	<400	3,500	16,000	0
19-May-25	Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	0
2-Jun-25	Faecal Coliform (MPN/100 mL)	<400	920	1,600	0
16-Jun-25	Faecal Coliform (MPN/100 mL)	<400	1,600	540	0

TABLE 2.9-8: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q2-2025*

Site	ID	WWTS	Key Non-Compliance Issues[2] in Q2-2025	Corrective Actions
OSOV 1 (Owner's Site Office and Village)	EF01	- Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m^3/day. - The effluent from this site flows into the Re-regulation Reservoir.	- Faecal coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q2 mean 1,690 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q2 mean 2,233 MPN/100 mL. - Total phosphorus (<2 mg/L): Non-compliance in 2 out of 6 samplings. Q2 mean 1.8 mg/L.	It was identified that no routine or clearly defined maintenance schedule was in place. As a result, EMO issued one ONC addressing the maintenance deficiencies of the WWTS at OSOV1.
OSOV 2 (ESD Camp)	EF13	- Septic tanks (kitchen and black water) and SBR with chlorination system. - The effluent from this site is led into a ditch connected to the Re-regulation reservoir, however,	- Total nitrogen (<10 mg/L): Non-compliance in 1 out of 6 samplings. Q2 mean 6.7 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q2 mean 3,823 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q2 mean 10,333 MPN/100 mL.	It was identified that no routine or clearly defined maintenance schedule was in place. As a result, EMO issued one NCR1 concerning the malfunction, specifically, a broken control panel, of the WWTS at OSOV2.

[2] The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues[2] in Q2-2025	Corrective Actions
		due to low quantities of effluent, the liquid is absorbed in the soil before reaching the reservoir.		These findings will be formally documented in the Q3 monthly report.
Main Powerhouse	EF19	- Septic tanks (grey and black water), biofilm tank and chlorination tank. - The effluent from this site flows into the tailrace of the Main Powerhouse and then into the Re-regulation Reservoir.	- Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6 samplings. Q2 mean 90 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6 samplings. Q2 mean 153 MPN/100 mL. - Total nitrogen (<10 mg/L): Non-compliance in 3 out of 6 samplings. Q2 mean 11.8 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in all 6 samplings. Q2mean 6.5 mg/L.	Cleaning all septic tanks and closely monitoring the residual chlorine content and chlorination dosage adjustment.

2.9.3 Groundwater Quality Monitoring

During Q2 2025, five boreholes at Somseun, Nam Pa and Thong Noy and Pou Villages (two boreholes) have been monitored for the following parameters:

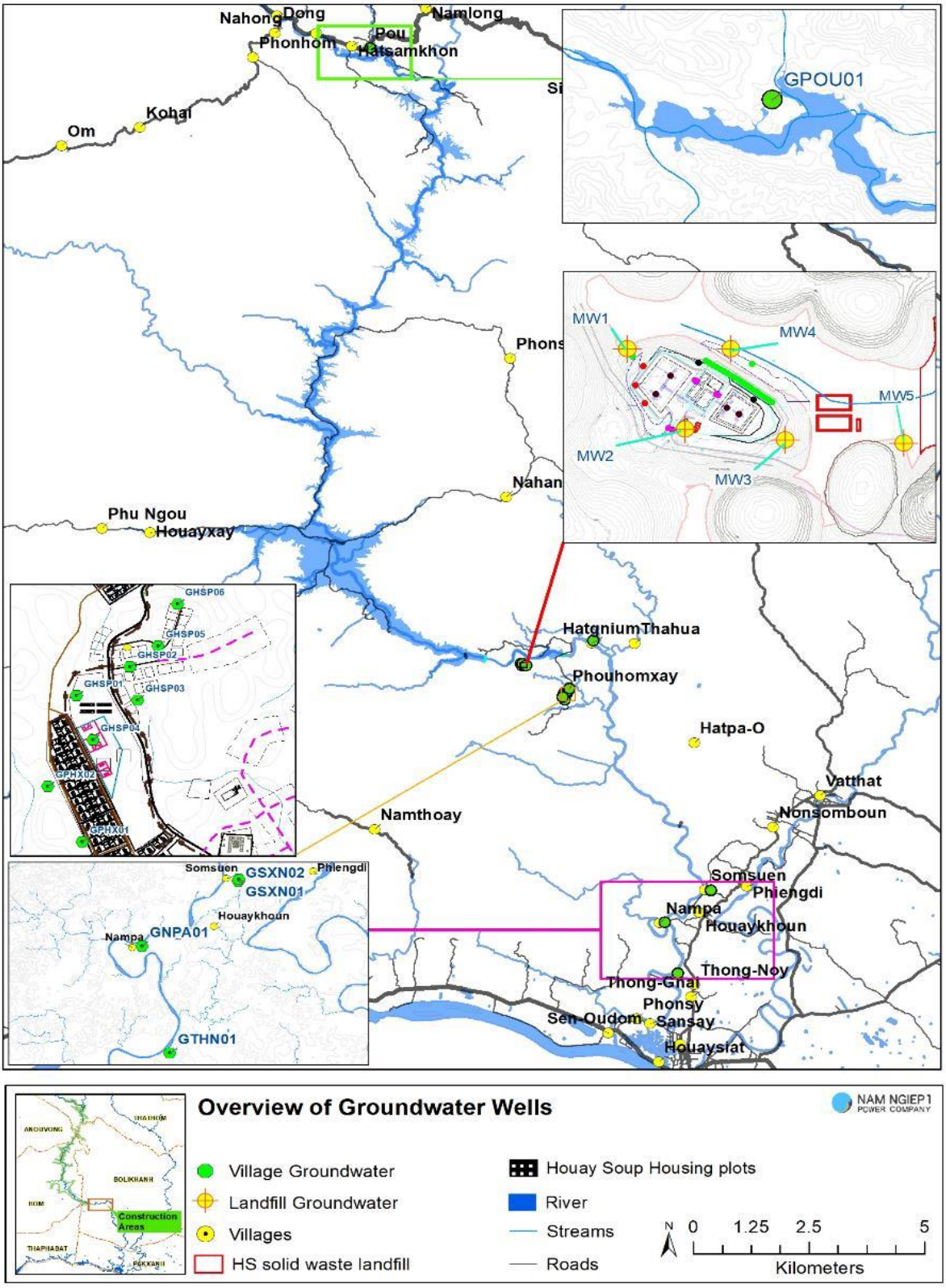
a. *Monthly:* pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU), Faecal Coliform (MPN/100 mL) and *E. coli* (MPN/100 mL);

b. *Annually (Not This Quarter)*: Arsenic (mg/L), Total Iron (mg/L), Magnesium (mg/L), Fluoride (mg/L), Total Hardness (mg/L), Nitrate (mg/L), Nitrite (mg/L) and Lead (mg/L).

Note that during Q2 2025, the water pumps of two boreholes (GPHX01 and GPHX02) in Phouhomxay Village were out of operation as they were broken. The Social Management Office (SMO) informed the EMO that these two boreholes will no longer be used, as villagers rely on gravity-fed water supply as their primary source. Therefore, the GPHX01 and GPHX02 have been removed from EMO's routine monitoring starting from January 2025.

The groundwater sampling locations are displayed in **Figure 2.9-9** and the groundwater monitoring data is presented in **Appendix 5-3.**

FIGURE 2.9-9*: GROUNDWATER SAMPLING LOCATIONS*



Key findings from the groundwater quality monitoring are summarized as the follows:

Thong Noy Village: all monitored parameters complied with the standard, except faecal coliform in May 2025.

Somseun Village: all monitored parameters complied with the standard, except faecal coliform in April and May 2025.

Nampa Village: all monitored parameters complied with the standard, except faecal coliform in Q2 2025 and *E.coli* bacteria in June 2025.

Pou Village: all monitored parameters complied with the standard, except faecal coliform in June 2025 for GPOU02 borehole.

The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

There are two types of water supply systems in Lao PDR:

(A) Nam Papa systems (water supply) – water from natural water sources that has gone through a treatment process to become clean and safe water in compliance with the drinking water quality standards. These systems are managed by the Department of Water Supply, Ministry of Public Works and Transport; and

(B) Nam Sa-at Systems (domestic water supply) – provide water to rural areas that are not connected to Nam Papa systems. Nam Sa-at systems include gravity fed systems and boreholes with motorised pumps or hand pumps. These systems are managed by the Centre for Environmental Health and Water Supply (Nam Sa-at) under the Department of Hygiene and Health Promotion, Ministry of Health.

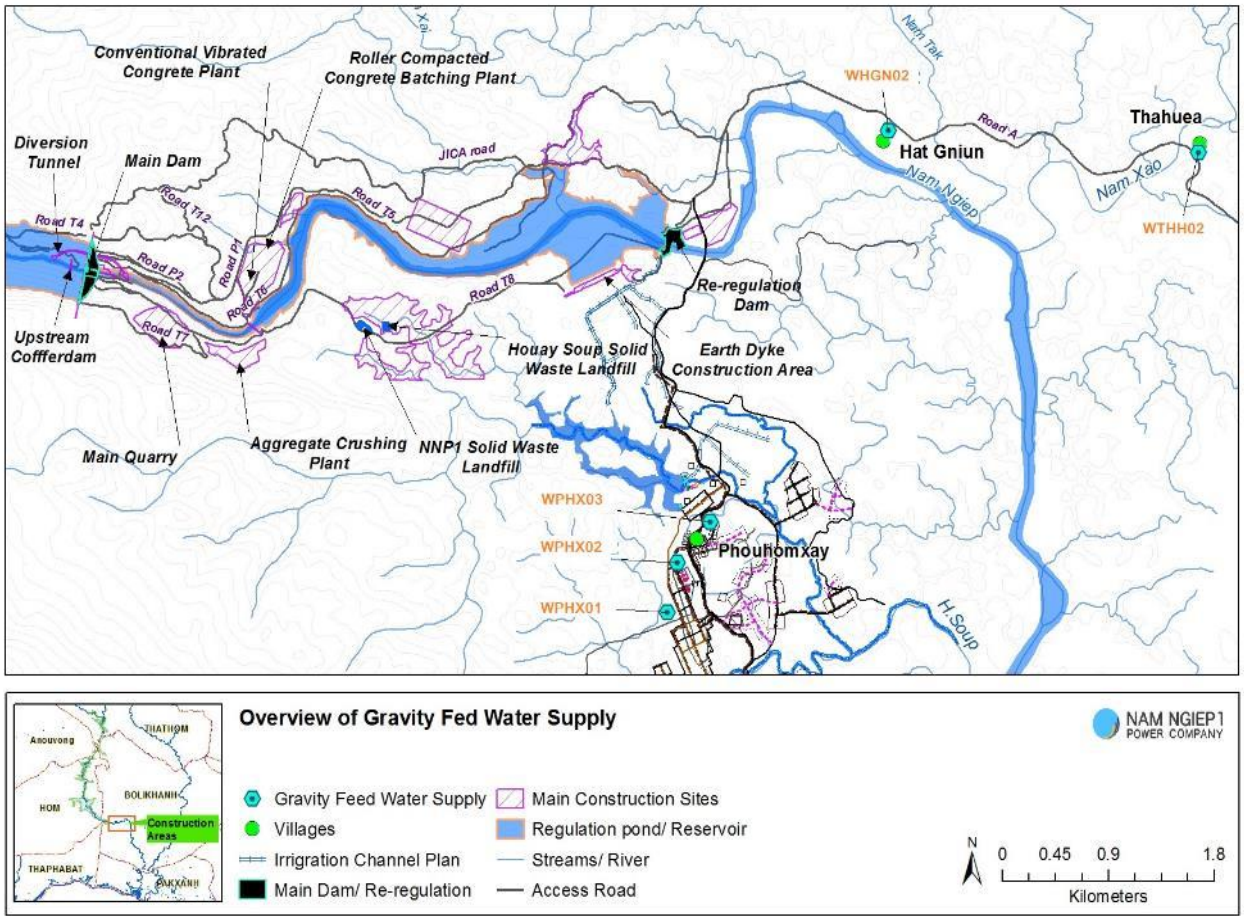
The community water supply systems related to the NNP1 hydropower project are under Nam Sa-at system with the monitoring requirements identify in the Minister's Decision on the Water Quality Standard Management for Drinking and Domestic Use, No. 561/MoH dated 27 February 2014.

The issue of bacterial contamination in the communities' water supply have been investigated by ESD team together with the respective local authorities and the villagers to find the likely root causes. A series of actions have been taken to prevent the contamination according to the Water Safety Plans (WSP); however, the Project, Nam Sa-at (GOL) and the villagers considered that disinfection treatment processes (e.g., chlorination, ceramic filtration) would not be sustainable and cost effective in a long run. It is well understood and agreed with the villagers that the water shall be boiled before drinking as mentioned above. It is also noted that boiling of water from domestic water supply (Nam Sa-at) systems before drinking is a general practice in the rural areas of Lao PDR.

2.9.4 Gravity Fed Water Supply (GFWS) Monitoring

The monitoring of the GFWS aims to assess the quality of water that is being used for bathing and washing by villagers at Hat Gniun, Thaheua and Phouhomxay villages. The gravity fed water supply system at Phouhomxay Village has been in use since December 2017.

FIGURE 2.9-10: *OVERVIEW OF GRAVITY FED WATER SUPPLY*



Water samples were taken from the taps for analysis during the reported period and selected results are shown in **Table 2.9-9**. The full set of data is presented in **Appendix 5-4.**

TABLE 2.9-9*: THE GFWS MONITORING RESULT IN Q2 2025*

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
		Guideline				
24-Apr-25	Faecal Coliform (MPN/100 mL)	0	11	35	12	9.3
22-May-25		0	4		1,600	1,600
23-Jun-25		0	8	27	70	540
24-Apr-25	*E. Coli* Bacteria (MPN/100 mL)	0	17	4.5	0	0
22-May-25		0	2		79	79
23-Jun-25		0	8	27	33	24

Thaheua Village (WTHH02): all parameters complied with the standard, except for faecal coliform and *E. coli*.

Hat Gniun Village (WHGN02): all parameters complied with the standard, except for faecal coliform and *E. coli*.

Phouhomxay Village (WPHX02-tap water at primary school; and **WPHX03**-tap water at a villager's house**):** all parameters complied with the standard, except faecal coliform and *E. coli* in the Q2 2025 samples. Note here that during sampling of tap water in Phouhomxay Village, surface water from Houay Soup Stream was still supplied into the system.

As observed in the field during water sample collection, livestock is roaming around in the water intake areas which may have contributed to the presence of Faecal Coliform Bacteria and *E. coli* in GFWS samples. According to the 2019 site condition survey, it is not feasible to fence off the upstream water course due to cattle having access from all directions along the steam. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and were advised to prevent the bacterial contamination by removing livestock from the intake areas and boil water before drinking. The advice to boil the water is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

As mentioned in **section 2.9.3**, the gravity fed system is a domestic water supply managed by the Centre for Environmental Health and Water Supply (Nam Sa-at) under the Department of Hygiene and Health Promotion, Ministry of Health. It is well understood and agreed with the villagers that the water shall be boiled before drinking.

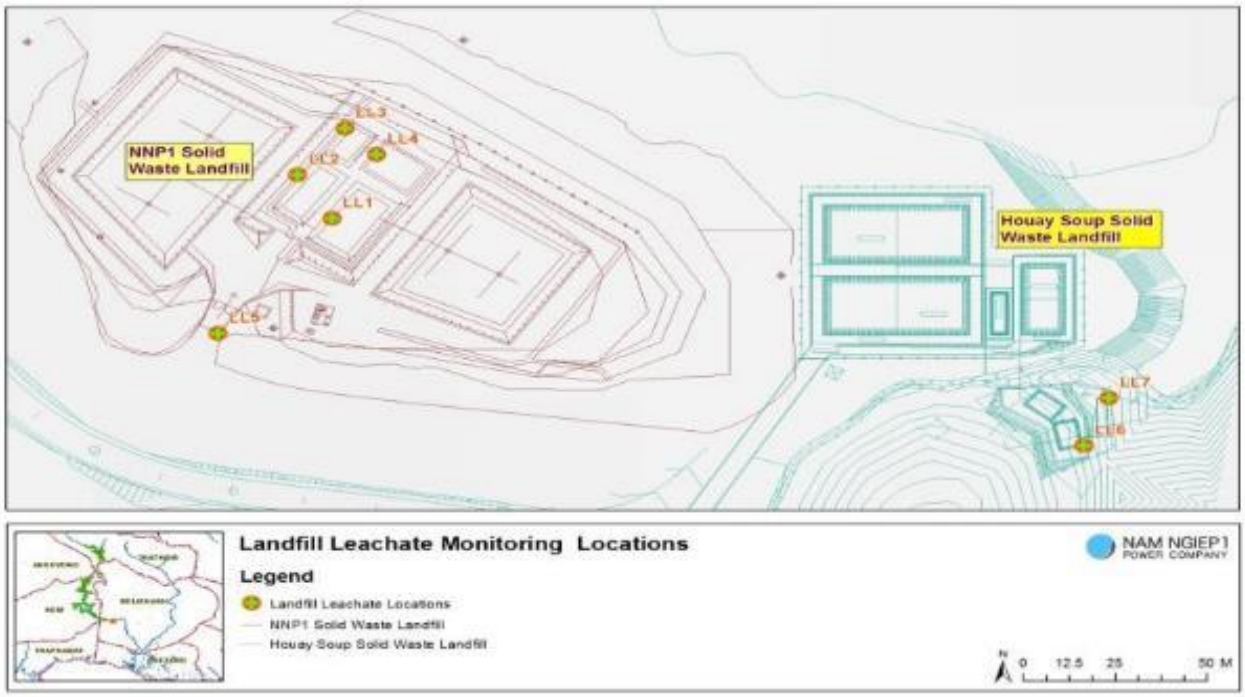
For Phouhomxay Village, the villagers requested NNP1PC and the District Water Supply Office during a meeting in March 2022 to reuse the Gravity Fed System (GFS) as a main supply and reserve the existing ground water supply system for times when the GFS would have to be repaired. The water from the gravity fed system needs to be boiled before drinking but may be used directly for other purposes such as washing, feeding animals, watering the garden, and other households' activities.

In addition, to ensure sufficient water quantity, the ESD will work with the District Water Supply Office to improve the water intake of the GFS under NNP1PC's Corporate Social Responsibility (CSR). For the presence of bacteria, the community confirmed that they will boil water before drinking. It is also noted that boiling domestic water supply (Nam Sa-at) before drinking is a general practice in the rural areas of Lao PDR.

2.9.5 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. Due to low rainfall during Q2 2025, the sampling of effluent could only be carried out in June 2025. The monitoring locations are presented in the **Figure 2.9-11**.

FIGURE 2.9-11: *LANDFILL LEACHATE MONITORING LOCATION*



The monitoring results in June 2025 indicate compliance with the applicable standards for all monitored parameters, except for faecal coliform and total coliform for both NNP1 Landfill Leachate and Houay Soup Landfill Leachate. However, there was no discharge or overflow of the leachate. The monitoring data can be found in **Appendix 5-5**.

2.9.6 Water Quality Compliance Monitoring

The water quality non-compliance issues in Q2 2025 are summarized in **Table 2.9-10**.

TABLE 2.9-10*: NON-COMPLIANCES RELATING TO WATER QUALITY MONITORING IN Q2 2025*

No	Non-compliance Issues	Corrective Actions	Status
1	During turbine discharge (May and June 2025), Dissolved Oxygen (DO) in the Nam Ngiep River downstream the Re-regulation Dam was lower than the National Surface Water Quality Standard (6 mg/L)	- NNP1PC has continued implementing the water quality monitoring program and discussed the results with the LTA during the May 2023 visit; - LTA recommended to maintain the monitoring program, and concluded that other measures aiming at an improvement, like e.g. the possibility of artificial re-aeration of the water in the re-regulation pond for increasing oxygen content, are not required.	- Closely monitoring
2	Effluents discharged from the Wastewater Treatment Systems	In April, May and June 2025, EMO, ADM and TD conducted a monthly joint inspection for the operation and maintenance of the WWTS:	- Closely monitoring the system

No	Non-compliance Issues	Corrective Actions	Status
	(WWTS) at OSOV1, OSOV2 and the Main Dam exceeded the National Effluent Standard Guideline for some parameters	- All 17 septic tanks and air blowers at OSOV1 were checked on monthly basis by the ADM staff and they are functioning properly. The sludge in these tanks are cleaned up yearly. - Wetland maintenance at OSOV1 including weeding and replacing dead reeds. - Closely monitor the residual chlorine content and chlorination dosage adjustment for the effluents of OSOV2 and the Main Powerhouse WWTS.	operation and maintenance.
3	Groundwater quality monitored for the communities (Nam Pa, Thong Noy and Som Seun Villages) were not in compliance with the National Groundwater Quality Standard for drinking purpose on Faecal Coliform and E.*coli* parameters	- A full inspection of the water supply systems in Som Seun, Nam Pa and Thong Noy Village was conducted in September 2020 by NNP1PC team including consultations with the Village Water Use Committee (VWUC) and also interviews with some consumers (detailed in Q4 2020 Report). - Potential contamination sources of coliform were identified and recommendations on operation and maintenance of the water supply system were provided to the involved parties. - The villagers were informed about the monitoring results and were advised to boil water before drinking in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.	- The villagers were advised and encouraged to boil water before drinking. - Continue to monitor.
4	Gravity Fed Water Supply monitored for the communities (Thahuea, Hat Gniun, and Phouhomxay Village) were not complied with the National Drinking Water Quality Standard on Faecal	- Site observations were conducted during the routine water sampling; it was observed that livestock was roaming around the water intake areas and faeces from livestock and birds may contribute to the presence of bacterial contamination. It is not feasible to fence off the upstream water course due to cattle having access from all directions along the steam.	- The villagers generally use tap water for washing and cleaning, and were encouraged to boil water before drinking.

No	Non-compliance Issues	Corrective Actions	Status
	Coliform and E.*coli* parameters.	The villagers were informed about the monitoring results and were advised to boil water before drinking.	- Continue monitoring.
5	Landfill Leachate Monitoring for both NNP1 and Houay Soup Landfills were not complied with the Effluent Standard for faecal coliform and total coliform.	- The leachate is still contained in the leachate ponds without being discharged to the environment. - Continue monitoring.	- Continue monitoring.

3 WATERSHED AND BIODIVERSITY MANAGEMENT

3.1 WATERSHED MANAGEMENT

3.1.1 Implementation of Watershed Management Plan

3.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)

a) Fishery Co-Management Plan (FCMP):

On 19 November 2024, XSB WRPO held an approval meeting for the Fishery Co-management Plan (FCMP) and associated regulations, chaired by the Vice Governor of Xaysomboun Province as head of XSB WRPC and with participants from the relevant provincial and district offices. In December 2024, XSB WRPO finalized the FCMP and appointed a committee to review the regulations to align with legal provisions. In Q2 2025, the Fishery Co-Management Plan (FCMP) was endorsed by the head of Xaysomboun Provincial Agriculture and Forestry Office (XSB PAFO) and the regulation is under finalization and is expected to be submitted to the Provincial Assembly Office and the XSB Provincial Governor for endorsement by Q3 2025.

b) NNP1 Watershed TPZs Encroachment Resolution

On 19 November 2024, the Vice Governor of Xaysomboun Provine as head of XSB WRPC assigned XSB PAFO in collaboration with Vice Governors of Hom, Anouvong and Thathom District, along with DAFOs to discuss strategies for resolving forest encroachment related with agricultural activities inside NNP1 watershed TPZs. The key outcome of the discussions included:

- Agreed to utilize remaining patrol budget under the previous AIPs for campaigns, education, information gathering and prosecuting violators starting from December 2024 to January 2025;
- Hom, Anouvong and Thathom districts to submit their workplan and budget to XSB WRPO for XSB Vice Governor' for review and approval by the first week of December 2024.

On 19 February 2025, Hom District Management Committee conducted inspection of illegal access road construction from Houayxay village to TPZ1 and instructed the violators to stop

the construction work and other unauthorised activities and remove the heavy equipment from the area. On 25-26 February 2025, Anouvong District Management Committee also conducted an outreach campaign in watershed villages such Om, Thamlo and Korhai villages.

On 19 March 2025, XSB WRPC and WRPO in collaboration with Hom, Anouvong and Thathom districts conducted a watershed site visit to observe the status of watershed TPZs encroachment and held a consultation meeting on 20 March 2025, which was chaired by Hom District Vice Governor and with participants from XSB WRPO, Hom, Anouvong and Thathom District offices. The results of the meeting are as follows:

- Request XSB WRPO to review the XSB Provincial Vice Governor's instruction on 19 November 2024 and allocate the remaining budget for three related districts to address forest encroachment.
- Request XSB WRPO to submit the list of villagers involved in forest encroachment to XSB WRPC.
- NNP1PC and XSB provincial military emphasized the need for a special task force committee as per the XSB PG instruction, the completion of the delayed reservoir checkpoints and the implementation of the Fishery Co-Management Plan (FCMP).

In Q2 2025, Thathom District Management Committee conducted outreach campaigns in the 7 watershed villages including Naxong, Phonhom, Nahong, Pou, Phiengta, Thaviengxay and Hatsamkhone. However, there is no progress from Hom District Management Committee.

c) Construction of Reservoir Checkpoints:

The construction of two reservoir checkpoints began on 6 December 2024 and the upstream reservoir checkpoint was completed in Q2 2025. The downstream checkpoint is expected to be completed in Q3 2025. XSB WRPO reported that staff deployment to these checkpoints will be resumed after completion of construction.

d) Patrolling:

XSB WRPO did not conduct TPZ, forest, or reservoir patrols. due to delays in submitting the 2025 activity plan to NNP1PC-EMO and BSP-WCS, as well as the financial report to XSB-WRPC.

3.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

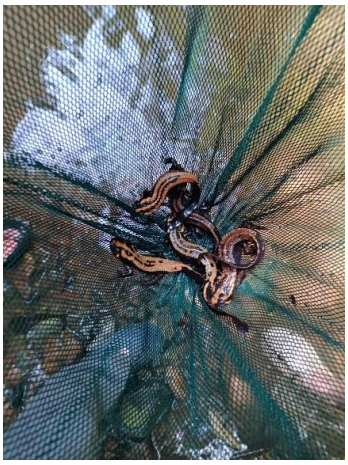
In Q2 2025, BLX WRPO resumed forest and reservoir patrols within the NNP1 watershed and reservoir.

3.1.1.3 NNP1PC EMO

In Q2 2025, NNP1 EMO and National University of Lao experts in collaboration with XSB WRPO and village authorities continued the Lao Newt and Bent Toed-Gecko survey within the NNP1 watershed. The results are being analyzed, and the survey report is expected to be submitted to NNP1 EMO and BSP-WCS in Q3 2025. In Q2 2025, Hom District Management Committee provided a training on pineapple jam production and packaging to the pineapple production groups in the PhouNgou and Houayxay villages. NNP1 EMO and Hom District relevant offices provide support the facilitation for the upcoming expos event in Q3 2025.

For progress of livelihood support activities for Thathom District in Q22025, Thathom District Management Committee disseminated production group regulations to the Kai Noy Rice and Rattan production groups in the Phonhom and Nahong villages. The committee also met with Thaviengxay Village authorities to review and restructure the weaving production organization.

NNP1 EMO expects that the weaving production regulation revision will be approved by the Thathom District governor in Q3 2025.

Lao Newt Monitoring (recapture) for the second phase within the NNP1 watershed




Bent Toed-Gecko survey within the NNP1 watershed




Training on the pineapple jam production and packaging approaches to the production groups in PhouNgou and Houayxay villages





Dissemination meeting for the handicraft and Kai Noy Rice production groups and Weaving Discussion group in the Nahong and Phonehom and Thaviengxay villages

3.1.2 Preparation of Annual Implementation Plan (AIP)

*TABLE **3.1-1*** provides an overview of the progress in preparing the Annual Implementation Plans (AIP) for 2024 and 2025 by Xaysomboun WRPO and Bolikhamxay WRPO and highlights of fund preparation, approvals, and transfer status.

TABLE 3.1-1 ANNUAL IMPLEMENTATION PLAN PREPARATION STATUS

Watershed and Reservoir Protection Office (WRPO)	Preparation of Annual Implementation Plan (AIP) 2024	Preparation of Annual Implementation Plan (AIP) 2025
Xaysomboun WRPO	**Status:** AIP 2024 for XSB WRPO was suspended due to the long delay in submission of the financial report and pending issues inside the NNP1 watershed	**Note:** AIP 2025 preparation is pending submission of the financial report as instructed by XSB provincial vice governor. **Status:** the remaining budget from the previous AIPs was allocated for some other activities to be carried out in 2025.
Bolikhamxay WRPO	– On 4 January 2024, the Bolikhamxay WRPO finalized their AIP2024, NNP1 EMO submitted it to ADB and IAP on the same day. – On 4 February and 5 March 2024, the IAP and ADB approved Bolikhamxay WRPO AIP2024 respectively. – On 28 March 2024, BLX WRPO submitted the fund disbursement request	– AIP 2025 preparation was discussed on 27 February 2025 – BLX WRPO submitted the first draft to NNP1 EMO for review on 4 March 2025. – Agreed to adjust the six last month fund of AIP 2024 to align with policy of MoF 0012, dated January 3, 2025. – BLX WRPO submitted the detail of adjustment plan to NNP1 EMO for review on 7 May 2025.

	letter to FPF-DOF-MAF. NNP1 EMO received the fund request letter from FPF-DOF-MAF on 1 July 2024 and transferred the funds to FPF-DOF-MAF account on 17 July 2024. BLX WRPO received funds in Q2 2025.	– NNP1 EMO returned comments to BLX WRPO for further improvement on 9 May 2025. – BLX WRPO submitted a funds request letter along with full plan to the Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF) on 16 May 2025. – NNP1 EMO received an official funds disbursement request letter to from FPF-DoF-MAF on 10 Jun 2025. **Status: NNP1PC transferred funds to FPF-DoF-MAF account on 23 June 2025 and expects that BLX WRPO will receive funds from FPF-DoF-MAF in Q3 2025.**

3.2 BIODIVERSITY OFFSET MANAGEMENT

3.2.1 Implementation of Biodiversity Offset Management Plan

Progresses on the implementation of activities by component in Q2 2025 are described as below:

a. Component 1 - Spatial Planning and Regulation

BSP-WCS shared the Participatory Land Use Plan (PLUP) of Sopkhone and Meungcham to NNP1-EMO and BOMU on 9 June 2025, NNP1-EMO has reviewed and reverted to BSP-WCS on 11 June 2025 with some comments for improvement. BSP-WCS continued working on the draft and expects to share the updated version with NNP1-EMO and BOMU in early Q3 2025. The PLUP are expected to be approved by Xaychamphone District Governor within Q3 2025.

b. Component 2 – Law Enforcement

Monthly patrolling and law enforcement

BOMU conducted monthly sub-stations safeguarding in March and April and patrolling in May and June 2025. The patrolling and law enforcement results of May and June 2025 are presented in **Table 3.2-1.**

TABLE 3.2-1: *MAY AND JUNE 2025 PATROLLING AND LAW ENFORCEMENT RESULTS*

Team	Patrol days	Distance (Km)	Observations			Law enforcement
			Hunting	Fishing	Timber	
1	32	181	1	0	0	
2	32	115	2	0	0	

Team	Patrol days	Distance (Km)	Observations			Law enforcement
			Hunting	Fishing	Timber	
3	33	107	1	0	3	
4	32	121	4	1	0	One Vietnamese hunter was encountered and received written warning letter
Total	**129**	**524**	**8**	**1**	**3**	

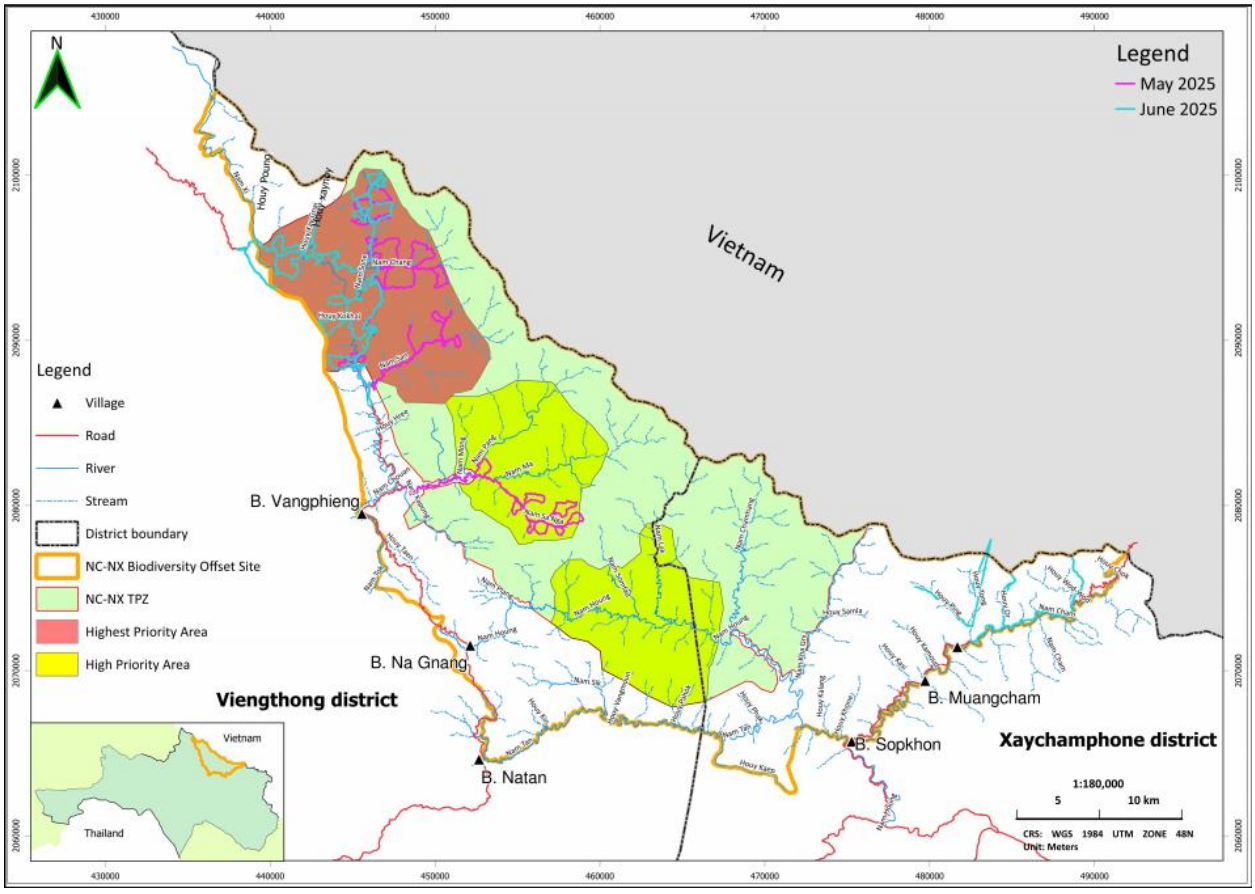


FIGURE 3.2-1: *MAY AND JUNE 2025 PATROLLING TRACK RECORDS*

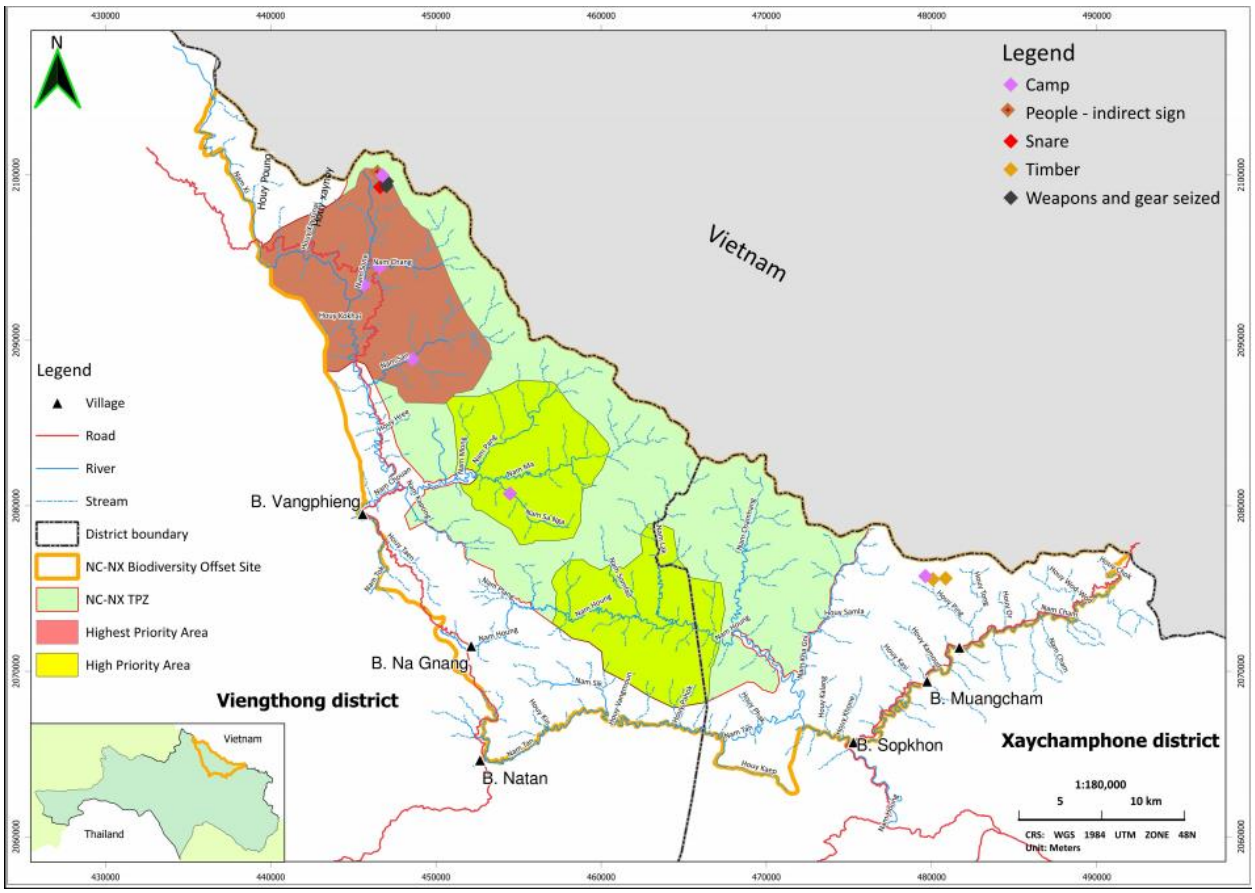


FIGURE 3.2-2: ***May and June 2025 Patrolling Threat Records***

	
An old hunting camp encountered and demolished at Nam Sa Nga in May 2025	A long wire snare line detected and collected at Nam Sone in May 2025

	
A long and active wire snare line detected and collected at Nam Sone in June 2025	A newly prepared wire snare line detected at Nam Sone in June 2025
	
A home-made gun was confiscated at Nam Sone in June 2025	A Vietnamese hunter was encountered and received written warning at Nam Sone in June 2025
	
Joint patrolling with Pu Mat National Park in June 2025	Old timbers encountered during the joint patrolling in June 2025

c. Component 3 – Conservation Outreach

- School outreach program: BOMU shared the improved Kamishibai storytelling materials (illustrations) with BSP-WCS and NNP1-EMO on 27 May 2025. However, the implementation

of the activity will be further postponed to Q4 2025 due to poor access road conditions to NC-NX villages and recent internal organizational changes within BSP-WCS.

- Village outreach activity: BSP-WCS provided training for the Viengthong and Xaychamphone District Outreach Teams from 26-28 May 2025. The relevant District Outreach Team, BSP-WCS, BOMU, and NNP1-EMO carried out a conservation outreach campaign in Vangphieng, Na Gnang, and Natan villages, as well as at the Viengthong market from 30 May to 1 June 2025. The campaign continued in Phonmeung, Meungcham and Sopkhone villages, and at the Xaychamphone market from 2-4 June 2025. Key results from the campaign are summarized as below:

Table 3.2-2: Key results from the conservation outreach campaign

Place	Number of participants	Key topics covered
Vangphieng village	52 (28 female)	- Benefits of forest - NC-NX regulation - NC-NX TPZ boundaries - List of Lao protected wildlife species
Na Gnang village	45 (20 female)	
Natan village	37 (25 female)	
Phonmeung village	52 (27 female)	
Meungcham village	54 (24 female)	
Sopkhon village	37 (19 female)	
Viengthong market	35	- Benefits of forest - List of Lao protected wildlife species
Xaychamphone market	25	



Outreach campaign at Vangphieng village on 30 May 2025 (evening)



Outreach campaign at Na Gnang village on 31 May 2025 (morning)

	
Outreach campaign at Natan village on 31 May 2025 (afternoon)	Outreach campaign at Viengthong market on 1 June 2025 (afternoon)
	
Outreach campaign at Xaychamphon market on 2 June 2025 (afternoon)	Outreach campaign at Phonmeung village on 3 June 2025 (evening)
	
Outreach campaign at Meungcham village on 4 June 2025 (evening)	Outreach campaign at Meungcham village on 4 June 2025 (afternoon)

d. Component 4 – Conservation linked livelihood

BSP-WCS and BOMU conducted consultations on Community Conservation Agreement (CCA), reviewing and updating village's Fish Conservation Zone (FCZ) as well as monitoring the provided livestock vaccines in Sopkhone, Meungcham and Phonmeung villages, Xaychamphone district

from 9-16 June 2025. The same activities were implemented in Vangphieng, Na Gnang and Natan villages, Viengthong district from 19-25 June 2025. The reports are being prepared by BSP-WCS as of the end of Q2 2025 and will be reported in Q3 2025.

The snare removal team conducted monthly snare removal patrol in May and June 2025 in the TPZ highest priority area. However, the team did not encounter any snares or other threats. There was no patrol in April 2025 due to the team members' unavailability.

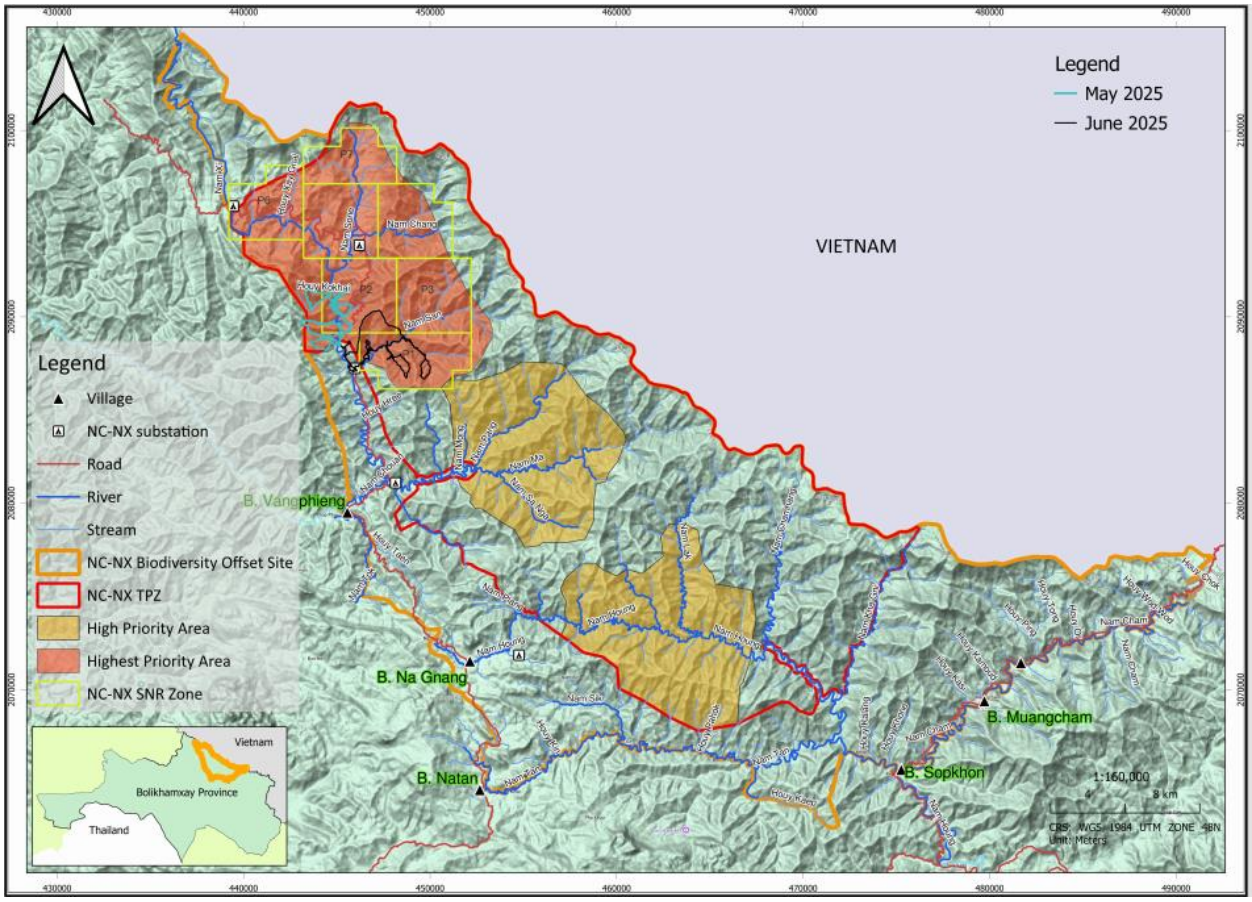


FIGURE 3.2-3: *May and June 2025 Snare Removal Track Records*

3.2.2 NC-NX AIP2024 Fund Disbursement

NNP1PC disbursed the NC-NX AIP2024 second six-month funds to DOF-MAF FPF's bank account on 30 January 2025, with a total amount of 2,288,366,900 LAK originating from two different sources: 1) Biodiversity Offset Management Fund under GOL's CA budget of LAK 855,267,823 and 2) No Net Loss (NNL) commitment under NNP1PC NNL Budget of LAK 1,433,099,077. BOMU received the funds from the Ministry of Finance on 6 May 2025.

3.2.3 Preparation of Annual Implementation Plan (AIP) 2025

NNP1 received no-objection confirmations from ADB and IAP on 4 and 5 June 2025, respectively. The plan is being processed for approval by Bolikhamxay PAFO as of the end of Q2 2025. Given that the plan has already been delayed, BOMU has proposed one-time disbursement of the total amount, and NNP1PC has agreed to this proposal.

3.2.4 The Wind Power Project

- The wind power project completed installation of two anemometer[3] stations (M3 and M4) on 19–20 April 2025.
- A joint site visit involving Bolikhamxay PAFO, BOMU, and PEM was conducted on 23–24 April 2025. As a result:
  - The wind power project agreed to relocate one anemometer station (M2) from inside the NC-NX TPZ highest priority area to outside of the NC-NX boundary. However, exact coordinates of the new location have not been shared by the Bolikhamxay Energy and Mines Office or the wind power project.
  - The Bolikhamxay PAFO and BOMU proposed to the wind power project to relocate station M5 which is planned to be installed deep inside NC-NX TPZ in Xaychamphone District.
- NNP1 has been engaging with BOMU and Bolikhamxay Provincial Energy and Mines Office to follow up on the proposed relocation of station M5 and obtain relevant information.

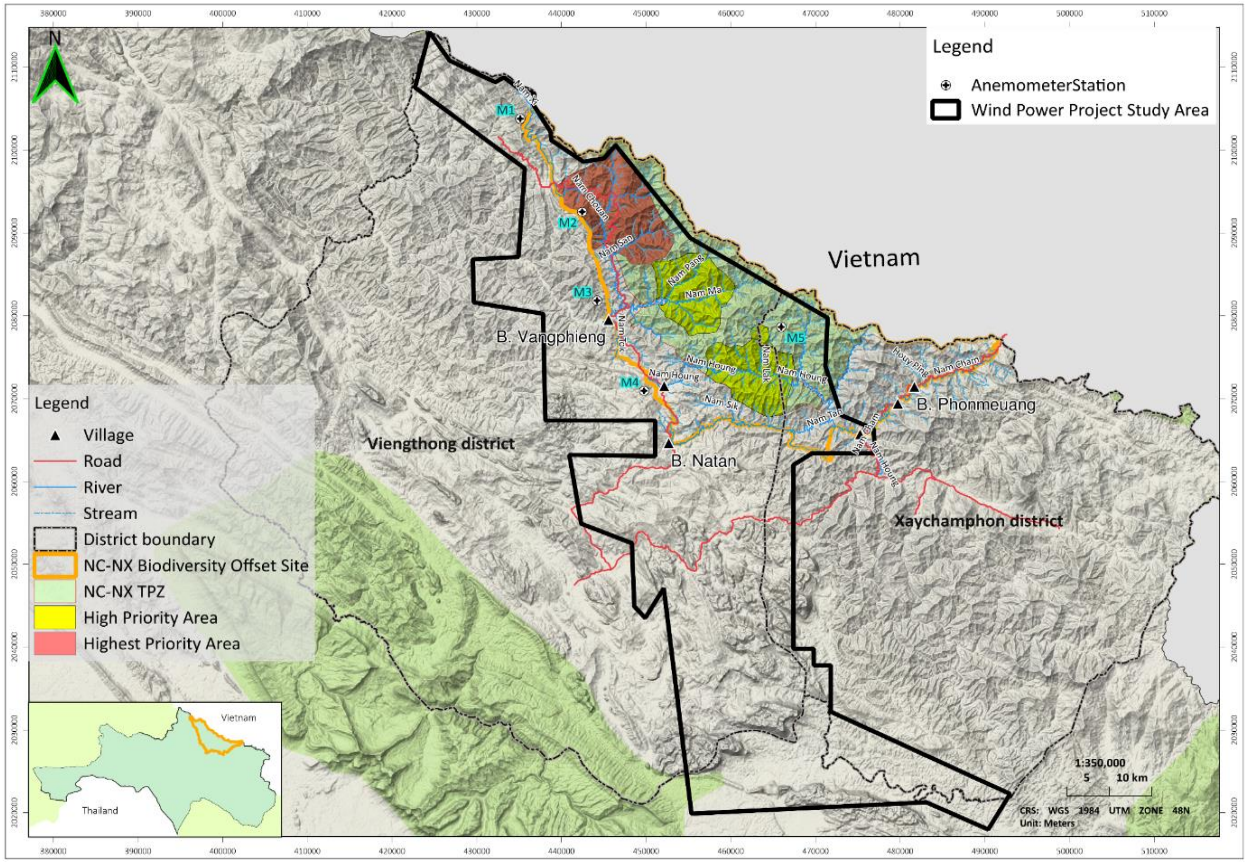


Figure 3.2-4: Map of the wind power project

[3] A device to measure wind speed and direction

4 FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in Q2 2025 as listed in **Table 4-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[1]and *Oreochromis niloticus* is an exotic species.

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN Q2 2025

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Oreochromis niloticus	ปานิน	511	LC (Exotic)
Barbonymus gonionotus, Hypsibarbus malcolmi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาก	297.6	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	239.8	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	213.7	LC
Mastacembelus armatus, Mastacembelus favus	ปาหาด	152.9	LC

The recorded catch of Threatened species (IUCN Red List classification) in Q2 2025 are presented in **Table 4-2**. The list includes three species which are classified as Vulnerable (VU).

TABLE 4-2: THREATENED SPECIES OF Q2 2025 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปาแกง/ปามอนจัม	1.2	VU
Scaphognathops bandanensis	ปาป่รม/ปาอรมไฟ	99.8	VU
Tor sinensis	ปาแดง	49.2	VU

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in Q2 2025. The catch is divided in 4 areas including upstream, above the main dam[4], below the main dam and Mekong area. Main biodiversity indicators in Q2 2025 for upstream, above dam, below dam and Mekong area are presented in **Table 4-3** and the Shannon biodiversity index has been calculated (the higher the value, the higher the diversity of species).

[4] Above dam includes lower reservoir and upper reservoir zones.

TABLE 4-3: MAIN BIODIVERSITY INDICATORS FOR Q2 2025

Biodiversity Indicators	Mekong	Below dam	Above dam	Upstream
Total species and groups	33	52	38	21
Single species	22	37	24	13
Species groups	11	15	14	8
Top 15 species (% total catch weight)	90.35%	81.81%	90.04%	94.11%
Proportion for species groups	24.92%	52.09%	45.51%	56.27%
Diversity index (Shannon)	2.7619	2.9827	2.6781	2.4831

Figure 4-1 shows fish diversity index (Shannon) for upstream, above dam, below dam and Mekong area from July 2015 to June 2025.

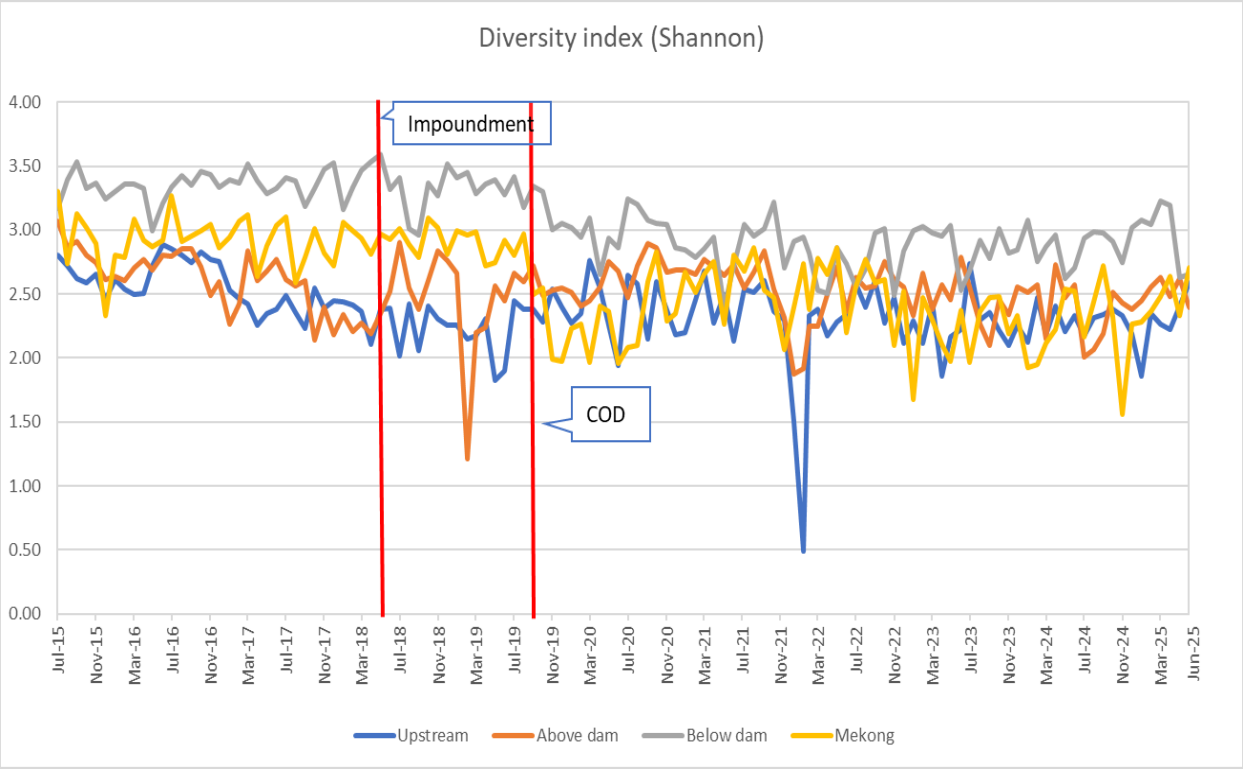


FIGURE 4-1: FISH DIVERSITY INDEX (SHANNON) BY FISHING ZONE FROM JULY 2015 TO JUNE 2025

The mean daily fish catch per household from July 2015 to June 2025 is displayed in **Figure 4-2** and the mean fish catch per household per fishing day for Q2 from 2016 to 2025 are shown in **Table 4-4.**

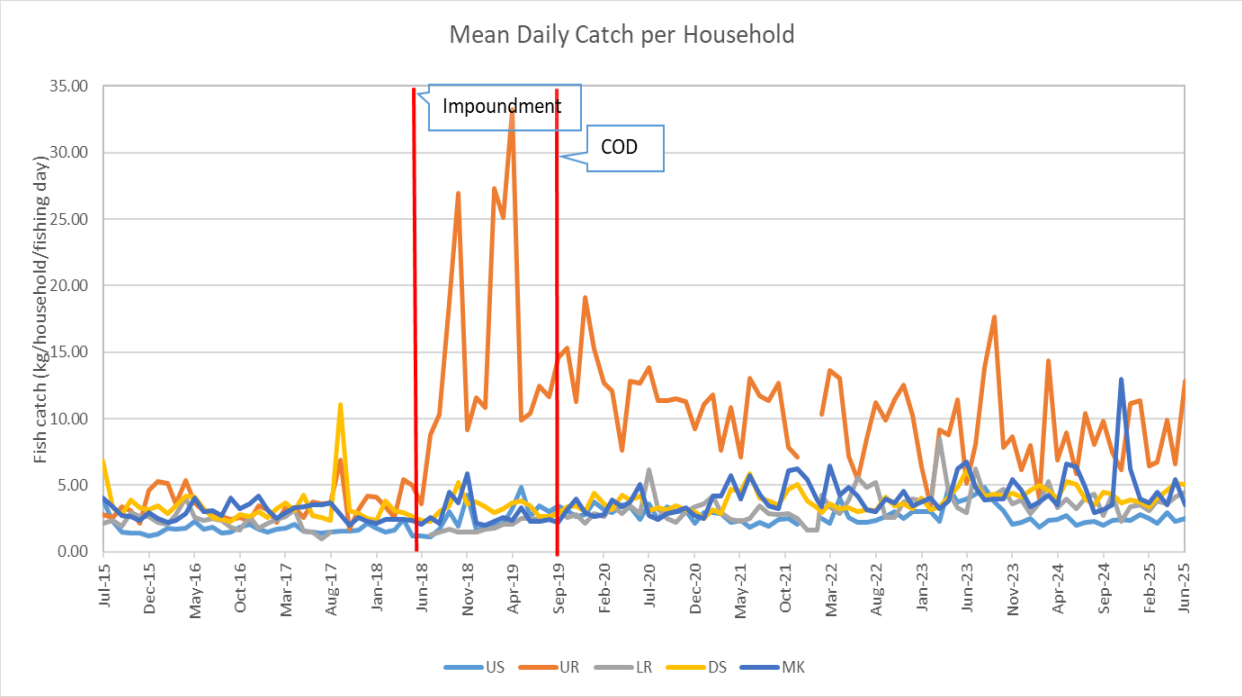


FIGURE 4-2: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JUNE 2025

TABLE 4-4: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR Q2 FROM 2016 TO 2025

Fishing Zone	Q2 2016 (kg)	Q2 2017 (kg)	Q2 2018 (kg)	Q2 2019 (kg)	Q2 2020 (kg)	Q2 2021 (kg)	Q2 2022 (kg)	Q2 2023 (kg)	Q2 2024 (kg)	Q2 2025 (kg)
Upstream	1.92	1.73	1.61	3.59	3.13	2.14	2.93	4.20	2.40	2.57
Upper reservoir	4.05	3.21	4.66	17.85	11.06	10.34	8.55	8.49	7.23	9.79
Lower reservoir	2.98	2.09	NA	2.37	3.08	2.41	4.13	3.60	3.51	4.05
Downstream	3.85	3.35	2.65	3.67	4.10	5.06	3.19	5.01	4.78	4.95
Mekong	3.31	3.39	2.30	2.65	4.06	5.13	4.44	5.59	5.51	4.16

The survey results in Q2 2025 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zones, while the main fishing habitat for the upper reservoir, lower reservoir, and Mekong zones is tributaries and stream, reservoir, and Mekong respectively. The proportion of fishing habitats in Q2 2025are displayed in **Table 4-5**.

TABLE 4-5: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN Q2 2025

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	8.8%	98.3%
Nam Ngiep	45.0%	9.9%	0.0%	54.8%	0.0%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	19.9%	87.2%	41.3%	0.0%	0.0%
Tributary and stream	35.1%	2.5%	56.6%	33.2%	0.0%
Wetland	0.0%	0.4%	2.1%	3.2%	1.7%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

The proportions of other aquatic animal (OAA) in the total catch for the same 7-day period in Q2 from 2016 to 2025 are shown in **Figure 4-3.**

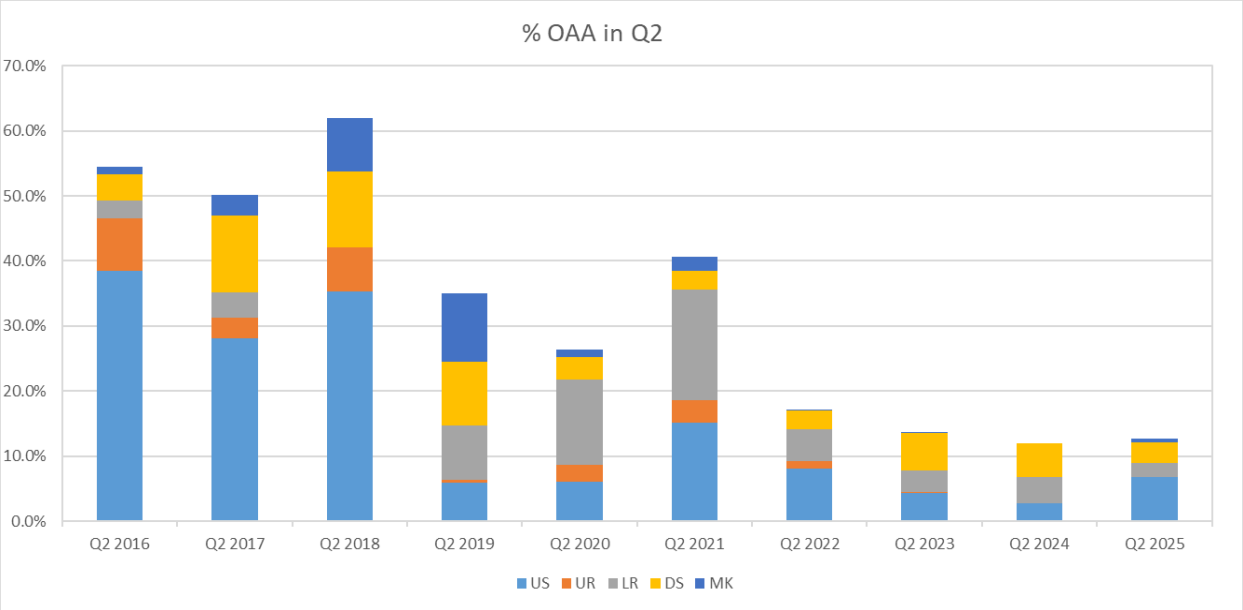


FIGURE 4-3: PROPORTION OF OAA TO THE TOTAL REPORTED KILOGRAM (KG) OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q2 FROM 2016 TO 2025

5 HEALTH AND SAFETY

5.1 RELATED TO NNP1PC HEALTH AND SAFETY

A summary of the safety incidents reported during the Construction Phase (up to the end of August 2019) are provided in the *Q4 2020 Environmental Monitoring Report (October to December 2020)*.

A summary of the safety incidents reported during the Operation Phase (September 2019 to June 2025) are provided in ***TABLE 5.1-1***.

TABLE 5.1-1: SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO JUNE 2025)

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in Q2 2025	0	0	0	0	0	1	0
Cumulative Total Incidents to 30 June 2025	0	3	0	0	0	2	**5**

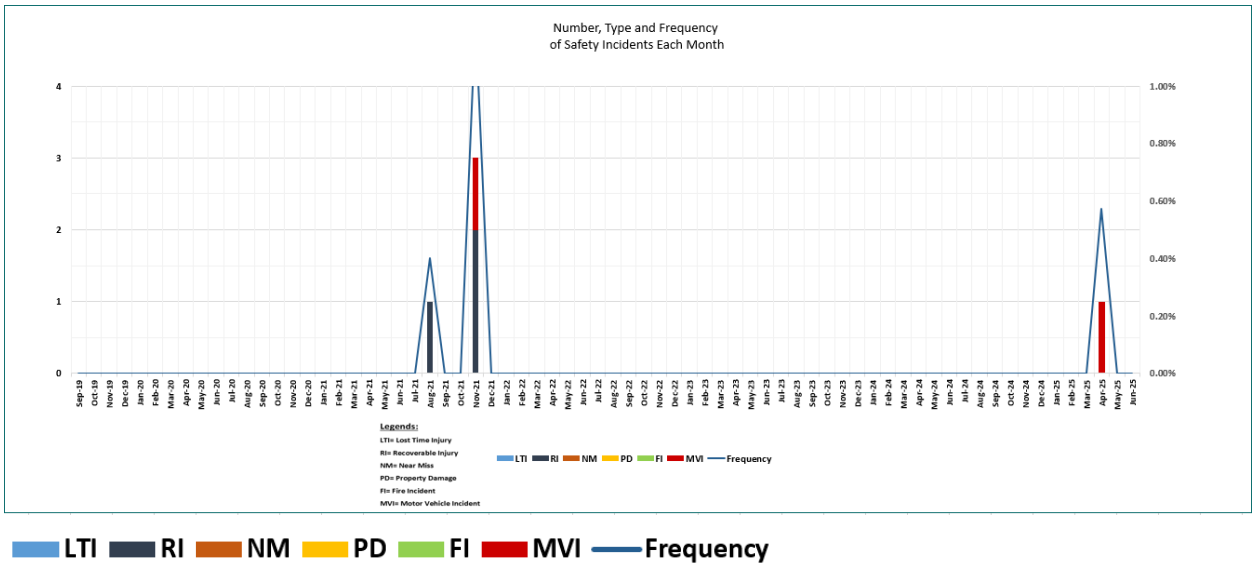
LTI: Lost Time Incident; **RI:** Recordable Injury; **NM:** Near Miss; **PD:** Property Damage; **FI:** Fire Incident; **MVI:** Motor Vehicle Incident

There was one incidents or accident reported in Q2 2025.

The histogram below in **Figure 5.1-1** shows the number of reported incidents in each month since the start of the Operation Phase (September 2019) with the colour indicating the type of incident including near misses. The graph superimposed on the histogram shows the frequency of incidents, including reported near misses, with the number of incidents occurring each month

expressed as a percentage of the total number of Project workers employed in each month being the total man-months.

All reported incidents that have involved the Owner and its Contractors and Subcontractors are included in the histogram and shown graphically below.



LTI: Lost Time Incident; **RI:** Recordable Injury; **NM:** Near Miss; **PD:** Property Damage; **FI:** Fire Incident; **MVI:** Motor Vehicle Incident

FIGURE 5.1-1: NUMBER, TYPE AND FREQUENCY OF SAFETY INCIDENTS FROM SEPTEMBER 2019 TO 30 JUNE 2025

The second histogram in **Figure 5.1-1** shows the number of persons who were injured, or lost their lives in the reported Lost Time Incidents.

In Q3 and Q4 of 2021, there were two cases of Recordable Injury (RI) and in Q4 2021 and Q2 2025 two cases of Motor Vehicle Incident (MVI) have been recorded.

5.1.1 Health and Safety Training and Emergency Drills in the Project site

During Q2 2025, Health and Safety and Environmental (HSE) inductions were conducted for newcomer contractors and visitors. The primary objective of these inductions was to ensure that all new personnel including staffs, contractors and local labours understand the HSE policy, measures and practices.







FIGURE 5.1-2: REPRESENTATIVE PHOTOS OF THE SAFETY INDUCTION TRAINING DURING Q2 2025

5.2 RELATED TO COVID-19

- The pandemic-related measures remain in effect. No COVID-19 infections were reported in Q2 2025.

6 External missions and visits

During the ADB-IAP-LTA Mission from 31 March – 05 April 2025, an onsite discussion took place with the LTA to seek recommendations for the food waste management at OSOV 1 canteen. The detailed findings from the mission are addressed in appendix 2 and a separated Corrective Action Plan (CAP).

APPENDICES

APPENDIX 1: THE SITE INSPECTION RESULTS DURING Q2 2025

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
1	ON-ADM-0021	23-Apr-25	OSOV1	It was observed that the hazardous waste bin was broken, which led to an oil spill on the ground that caused soil contamination.	ADM was instructed to take immediate action to clean up the spill. •The damaged bin needs to be replaced and appropriately labelled with a clear and visible poster to ensure proper containment of hazardous materials. •This incident highlights the need for regular inspections and maintenance of waste disposal bins to avoid future occurrences of the incident.P59	Immediately	21-May-25	**Resolved** (The corrective action was verified and accepted)
	ON-ADM-0022	23-Apr-25	OSVO1	It was observed that the storage room was not properly management and lacked effective housekeeping practices. Mix materials/equipment store in room untidy manner, creating potential environmental and safety risks	ADM was instructed to perform housekeeping and organize the materials properly. The following actions are required: •Identify and list all materials in the storage room, ensuring that each item is categorized and stored in a designated area. •Store materials in an orderly manner to ensure easy access and safe handling.	Within Apr 2025	24-Jun-25	**Resolved** (The corrective action was verified and accepted)

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
					•Remove any unused or outdated materials for proper disposal or, if applicable, donate them to local villagers as necessary.			
	ON-TD-0023	23-Apr-25	Main Dam Powerhouse	It was observed that the temporary hazardous waste storage was block by improperly placed materials, restricting access. A few used oil drums were full, but no transportation had been arranged to the designated storage facility. Proper management is crucial to ensure safe handling of hazardous materials and waste.	• TD was instructed to install a clear boundary line for the temporary hazardous materials and waste storage area. No placement of any equipment or materials in front of the boundary line to maintain proper access and organization within the storage area. • TD was instructed to arrange the transportation of hazardous waste (used oil) to the designated storage facility (LILAMA ‘s storage)	Within Apr 2025	24-Jun-25	**Resolved** (The corrective action was verified and accepted)
	ON-TD-0024	23-Apr-25	Storage Facility ‘s LILAMA10	It was observed that the SCI contractor’s hazardous contamination waste is being stored at the LILAMA facility, but it has not yet been properly segregated. Additionally, the waste has been placed outside the designated bunded facility.	• TD was recommended to properly segregate and correctly placement of the hazardous contamination waste within the bunded area to minimize environmental risks and comply with safety standards.	Within Apr 2025	21-May-25	**Resolved** (The corrective action was verified and accepted)

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q2 2025

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
1	**EAP**	EAP is under revision and will be submitted to Government for comments and approval (in April 2025?). Dam Safety Panel is not included in the process.	NNP1 to share the copy of the EAP to ADB	July 2025	**In Progress** - The EAP was submitted to DESM in May 2025 and is currently under review. - The draft EAP was shared with ADB on July 31, 2025. - The relevant submission letter was also shared with ADB on July 31, 2025.
2.a	**Houay Soup Dam**	Houay Soup dam (irrigation reservoir): As per LTA's view, in the case of a dam break, the village would not be affected (on higher ground, protected by a small hill. However, people at the demonstration farm and people working in the fields would be at risk.	NNP1 to confirm if the dimension and sufficiency of the spillway.	August 2025	**In Progress** - Details will be provided in the Village Emergency Evacuation (VEE) Drill 2025 Report. - The 2025 Village Emergency Evacuation Workshop and Drill Report is currently being prepared in collaboration with the District Disaster Management Committees (DDMCs) of Bolikhan and Paksan Districts. The report is approximately 60% complete and is expected to be finalized in Q3 2025.
2.b			Based on the outcome of the confirmation, a warning system should be established [e.g., ideally through a WhatsApp group].	August 2025	

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
3.a	**Muster Points**	Hat Gnuin Muster Point: The muster point is at 1.5 km from the village => people will not have enough time to reach it.	Identify a closer hill to the village that can be an alternative	August 2025	
3.b			Verify the elevation levels of both the current and alternative muster points.	August 2025	
3.c			Improve access and safety going to the muster point (e.g., maintain clear paths, access improvements due to steep terrain, install signages, ensure that gates can be opened during emergency)	August 2025	
4.a		Muster Point at Thahuea	Verify the elevation level of the muster point	August 2025	
4.b			Evaluate the community request to provide structure (e.g., toilets, drinking water storage) at the muster point	August 2025	
5.a	**Reporting of environmental incident**	(a) Oil Leakage in Unit No. 1, Main Power House and (b) Part C of Unit 1 SF6Switchyard was damaged due to	Include incidents in the periodic reports submitted to ADB	These incidents, as well as any that may arise, will be reported in the Environmental Quarterly Progress	**Completed** In January 2025, NNP1 submitted an incident report on the oil leakage in Unit No. 1 of the Main Powerhouse and Part C of the Unit 1 SF6 Switchyard to the LTA for review and comments.

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
		lightning strike at tower No. 1		Report to be submitted to ADB, beginning with the Q1 2025 report, which is scheduled for submission in Q2 2025.	- The LTA and NNP1 conducted a verification inspection during the ADB-IAP-LTA mission in early April 2025. - NNP1 followed up on the additional corrective actions and ensure that updates are reflected in the report. - The email exchanges between NNP1-EMO and LTA in '**RE: Q3 2024 Report**' were shared with ADB on July 31, 2025, for reference.
5.b			Review the safeguards and social reporting event in the legal agreement	Q2 2025	**Completed** - The safeguards and social reporting provisions in the legal agreement have been reviewed. - The internal email to NNP1PC teams, titled ***"Review of ADB Safeguard Requirements and Required Reporting Actions,"*** was shared with ADB on July 31, 2025, for reference.

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
6.a		Issues at the Contractor Workhop: - poor housekeeping - Spots showing sign of soil contamination with oil. Needs to be cleaned, contaminated soil to be removed and safely disposed. - has an underground fuel tank	Develop an action plan to address the site findings	Completed	**<u>In Progress</u>** - The SCI contractor's workshop was decommissioned in early April 2025, one week after the ADB-IAP-LTA mission concluded. - The ***Site Inspection Report and*** the actions implemented for hazardous waste management were shared with ADB on July 31, 2025**,** with relevant information found on: (1) Site Name: SCI Contractor's Workshop) – highlighting the ongoing rehabilitation work by TD. (2) Site Name: LILAMA10_Hazardous Material and Waste Storage Facility) – describing the corrective actions taken for hazardous waste. - NNP1-TD will carry out the rehabilitation works in accordance with the standards outlined in the SDRP. - While a specific completion date has not been set, both parties have agreed that the rehabilitation activities will continue through the end of the 2025 wet season.
6.b			Implement the agreed action	Completed	

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
					- The NNP1-EMO will conduct monthly joint environmental site inspections and provide regular progress updates on a monthly basis.
7	**Waste management**	Poor housekeeping in waste storage and material storage areas	Conduct housekeeping in the waste storage and material storage areas	Ongoing	**Completed** Housekeeping of the temporary waste storage facility at OSOV1 has been completed. The relevant report (**FR_S02_02-Site Inspection Report_21 May 2025_NNP1-ESD-EMO-SIR-ADM-TD_0021)** was shared with ADB on July 31, 2025. - Housekeeping of the material storage facility is ongoing and is expected to be completed by mid-June 2025.

8.a		Canteen food waste: Significant amounts of food waste. However, the reported figures only account for the portion collected by farmers and do not represent the full extent of food waste. A substantial amount is discarded as general waste and ends up in landfills, making the actual total much higher. Currently, surplus food is often given to farmers to feed pigs. However, this practice may become unacceptable in the future due to concerns such as African Swine Fever (ASF).	Raise awareness for the importance of pre-ordering meals.	July - August 2025	**<u>Ongoing</u>** On February 13, 2025, NNP1's waste management team interviewed the new canteen service provider and the NNP1 ADM team to identify the root causes of increased food waste. **Key findings:** 1. The new service provider, operational since January 2025, is still adjusting meal preparation to align with actual staff demand. 2. Approximately 40% of staff did not pre-book meals in January and February, resulting in a high number of unplanned walk-ins. **Actions taken to address the issue:** 1. On 19 February 2025, NNP1 issued an internal notice encouraging all staff to pre-book meals in order to reduce food waste. Evidence of this action was shared with ADB on July 31, 2025, for reference. 2. Awareness training will be conducted during the annual training session scheduled for July–August 2025.

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
8.b			Try to find out if persons from certain groups come unannounced especially often, if yes, go through the section head.	Ongoing monitoring	- NNP1 will continue its routine monitoring, follow up on record-keeping with the canteen operator and report findings on a monthly and quarterly basis. - The required actions have been confirmed and implemented.
8.c			Continue monitoring.	Ongoing monitoring	
Social Matters					
9	**E&S Capacity** Unfilled E&S positions	Action from April 2024 and status Fast track appointment to vacant positions Status as of April 2025: Partially completed. TL-livelihood PHX/ Z4 & Z3 is still vacant.	Ensure appointment to key positions based on the Updated Livelihoods Development Plan (2025-2029).	Jul-25	**<u>In Progress</u>** - Since the consultant team is from the GOL, the Updated Livelihood Development Plan (2025–2029) has experienced delays due to the need to await structural changes within the Ministry of Agriculture and Environment and other relevant agencies. The draft plan is now expected to be completed in Q3 2025, after which it will be shared with ADB, IAP, and LTA for review and feedback. - As a result, **the discussion on filling the vacant position within the Livelihood Team will be postponed until the plan is finalized.**

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
10	**Fisheries Co-Management Plan (FCMP)** Delay in the approval and implementation of the FCMP	Follow up and support the relevant GOL offices in reviewing and approving the FCMP (Status as of April 2025: Approved by XASB WRPC in Nov 2024.)	Follow up approval of FCMR with GOL and ensure implementation of FCMP	Jul-25	**<u>In Progress</u>** - Based on the latest follow-up in July 2025, the FCMP was endorsed by the Head of XSB PAFO in May 2025, and the **FCMR was finalized in June 2025**. - However, **NNP1 expects that the documents will be submitted for approval by August 2025.**
		Start FCMP implementation (Pending. Awaiting approval of FCMR by Provincial Assembly Office and XSB Provincial Governor)			

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
11	**Grievance Management** Access restriction of 21 HH to 3 paddy fields when the reservoir reached FSL at 320 masl.	Resolve access restriction of 21 HHs (Status as of April 2025: Partially completed. 13 of 21 cases closed. Outstanding actions are related to (i) installing culverts to function as draining canal for paddy field of 4 HHS in Pou; (ii) building 1-km tractor road 4 HHs in Hatsamkhone.)	Fully resolve 8 outstanding cases	May-25	**In Progress** - The **installation of culverts serving as drainage canals and an access road across** Houay Pou Creek to the paddy fields of 4 households in Pou Village was **completed and documented** in July 2025. The payment to Pou Village is scheduled to be completed in early August 2025. - The **construction of a 3-km tractor road** for 4 households in Hatsamkhone Village has also been **completed and documented** in July 2025. The payment to the Contractor is scheduled to be completed in early August 2025.
12	**BOMP** No clear link of livelihood programs to conservation. High demand for rice land expansion	WCS to prepare ToR, identifying alternative sustainable economic activities and market chain analysis	Update NC-NX Livelihood Program (section 5 in CDP), through collaborative efforts of EMO and SMP	Sep-25	**In Progress** - BSP-WCS, BOMU, and NNP1-EMO **will conduct a field visit to all NC-NX villages after the rainy season** (October 2025) to confirm and update the CDP activities, as well as to engage in discussions regarding the community-managed irrigation system located outside the buffer zone.
			Install community-managed irrigation system outside	Dec-25	

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
			buffer zone to increase rice harvest frequency		- The **updated plan is expected to be finalized by November 2025**.
13	**Encroachment into PHX land**	Formalize 2ndgeneration land (not completed).	Conduct mapping of PHX land (including G2 and village lands) to determine encroached and unencroached lands for submission to GOL	Oct-25	**In Progress** Resolutions on land encroachment are being implemented in phases. **Bolikhan District has returned three plots of encroached land to the Phouhomxay village** authorities for use by the second generation of PAPs and for cemetery purposes.
14	**Updated Livelihood Development Plan**		Deliver to ADB the Updated Livelihood Development Plan (2025-2029) incorporating the following: ➢ Inputs from consultations with stakeholders including vulnerable households and lagging households ➢Corrected income data ➢ Time-series data and analysis of occupational participation for each village ➢Sub-plan for landless and near landless AHs on non-land-based livelihoods with comparable income streams ➢ Clear market linkages	Jun-25	**In Progress** - Since the consultant team is from the GOL, **the Updated Livelihood Development Plan (2025–2029) has experienced delays** due to the need to await structural changes within the Ministry of Agriculture and Environment and other relevant agencies. **The draft plan is now expected to be completed in Q3 2025, after which it will be shared with ADB, IAP, and LTA for review and feedback.** - **The requested information has been shared with the consultants** and will be incorporated into the updated plan accordingly.

No.	Aspects	Aspects and Observations from previous mission	Required Actions (April 2025 mission)	Delivery Timeline	NNP1 responses_31 July 2025
15	**E&S reporting**		Submit the Jan-July 2024 Social Monitoring Report to ADB for disclosure	Apr-25	**Completed** Social report disclosed on ADB website
			Incorporate time series data on occupational participation		**Duly Noted** The requested information will be incorporated into the preparation of the next report.

APPENDIX 3: SITE CODES, LOCATIONS AND MONITORING PARAMETERS OF THE SURFACE WATER QUALITY MONITORING

SITE CODES AND LOCATION STATION FOR SURFACE WATER QUALITY MONITORING

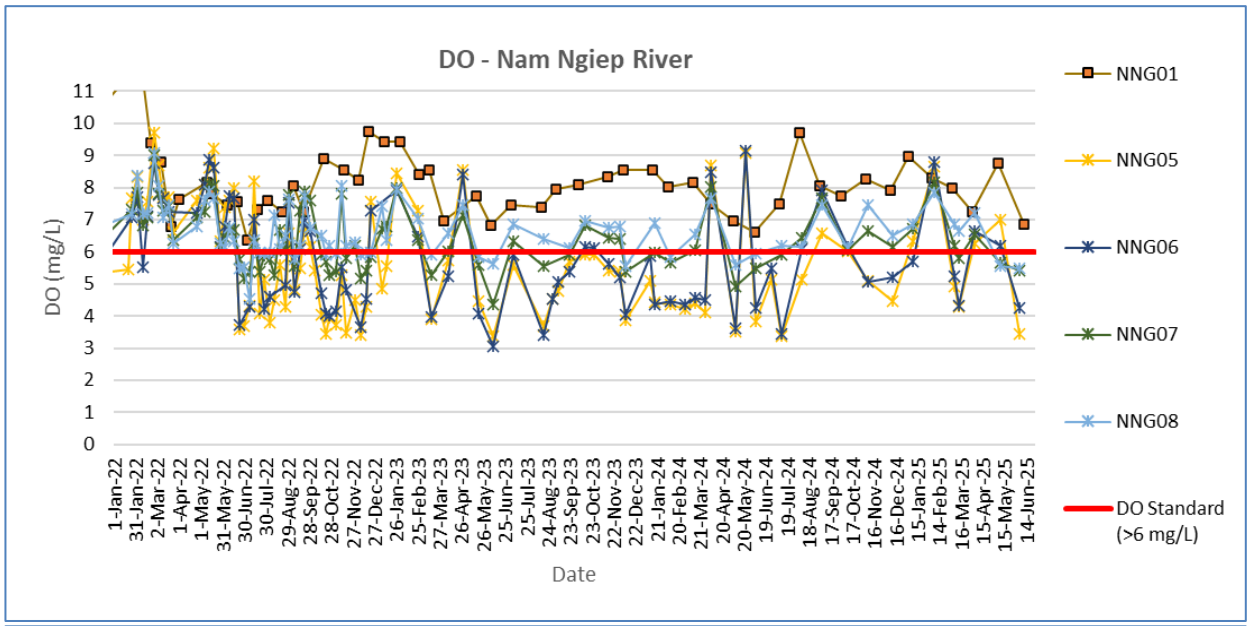
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Phiengta Village	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Sopyouak Village/ Main reservoir upstream main dam approx. 13 Km.	
NNG09/R05	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	
NNG04/R06	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	Within Project Construction Site
R07	Reservoir Upstream Re-Regulation Dam	
NNG05	Nam Ngiep Upstream of Hat Gniun Village	Downstream Project Construction Site
NNG06	Nam Ngiep Downstream of Nam Xao Confluence	
NNG07	Nam Ngiep at Somsuen Village	
NNG08	Nam Ngiep at the Bridge of Road 13	
NCH01	Nam Chiane at the Bridge of Road 1D	Tributaries Upstream of Project Construction Site
NPH01	Nam Phouan Upstream of Nam Ngiep Confluence	
NXA01	Nam Xao Upstream of Nam Ngiep Confluence	Tributaries Downstream of Project Construction Site
NSH01	Nam Houay Soup Upstream Nam Ngiep Confluence	

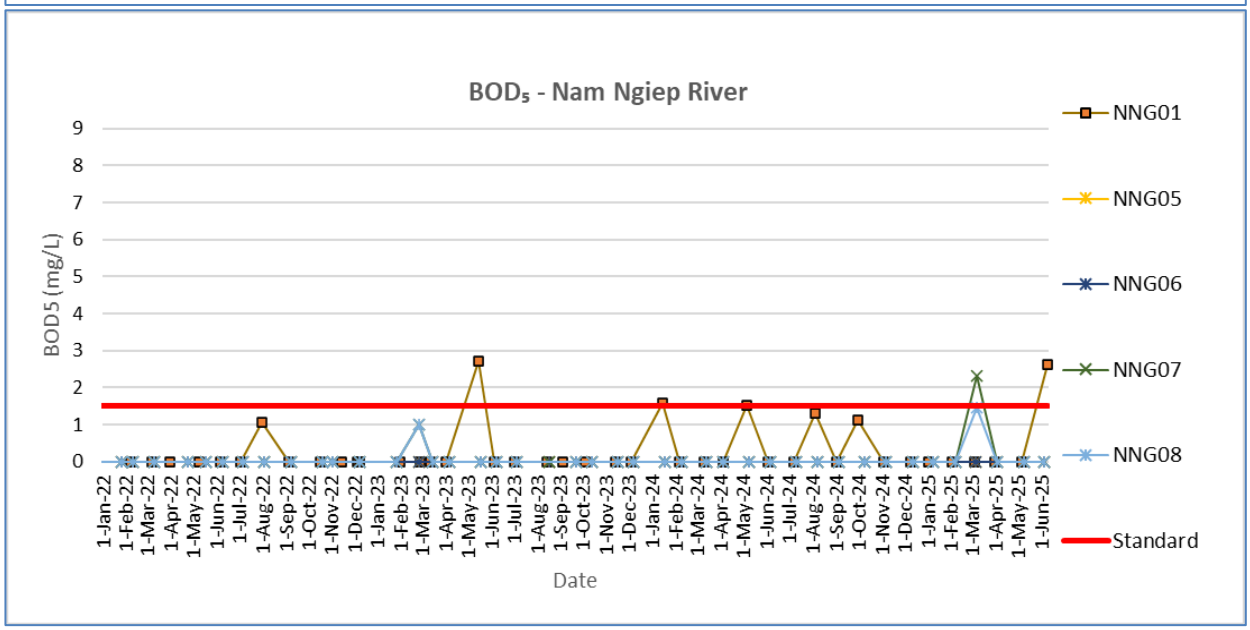
MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

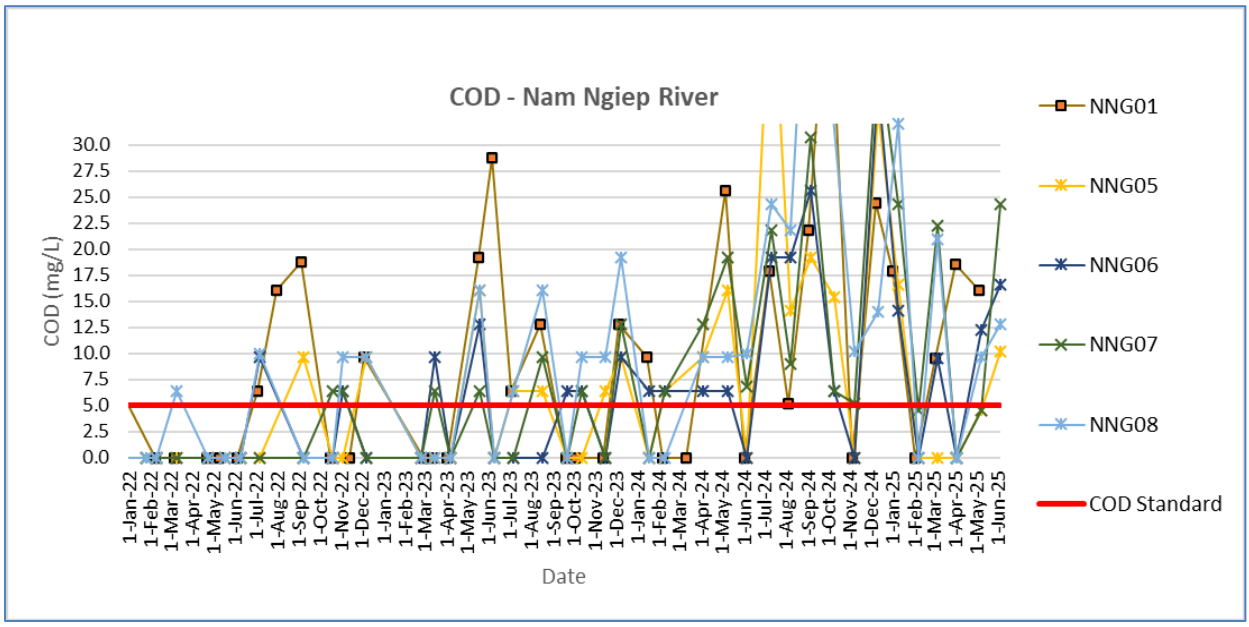
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R01, R02, R03, R04, R05; - Re-regulation Reservoir: R06 and R07.
Monthly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU).	- NNG01, NCH01, NPH01, NNG05, NNG06, NNG07, NNG08, NXA01 and NHS01
Monthly	TSS (mg/L), BOD_5 (mg/L), COD (mg/L), NH_3-N (mg/L), NO_3-N (mg/L), total coliform (MPN/100 mL), faecal coliform (MPN/100 mL), Chlorophyll a, TOC and TKN.	As per ESMMP-OP. Noted: Hydrogen sulphide and Phytoplankton biomass remained in the analysis program for Q1 2023, but they were no longer monitored starting from Q2 2023.

APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2022 TO END OF JUNE 2025 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)

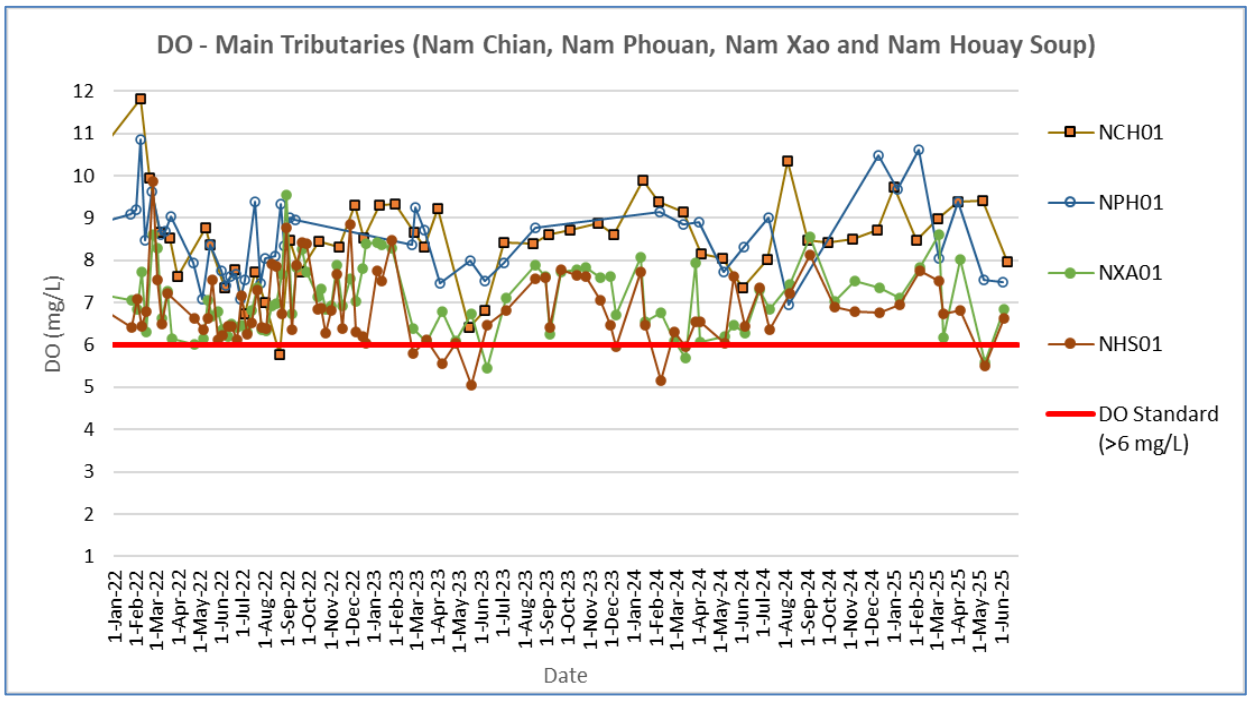
Nam Ngiep Surface Water

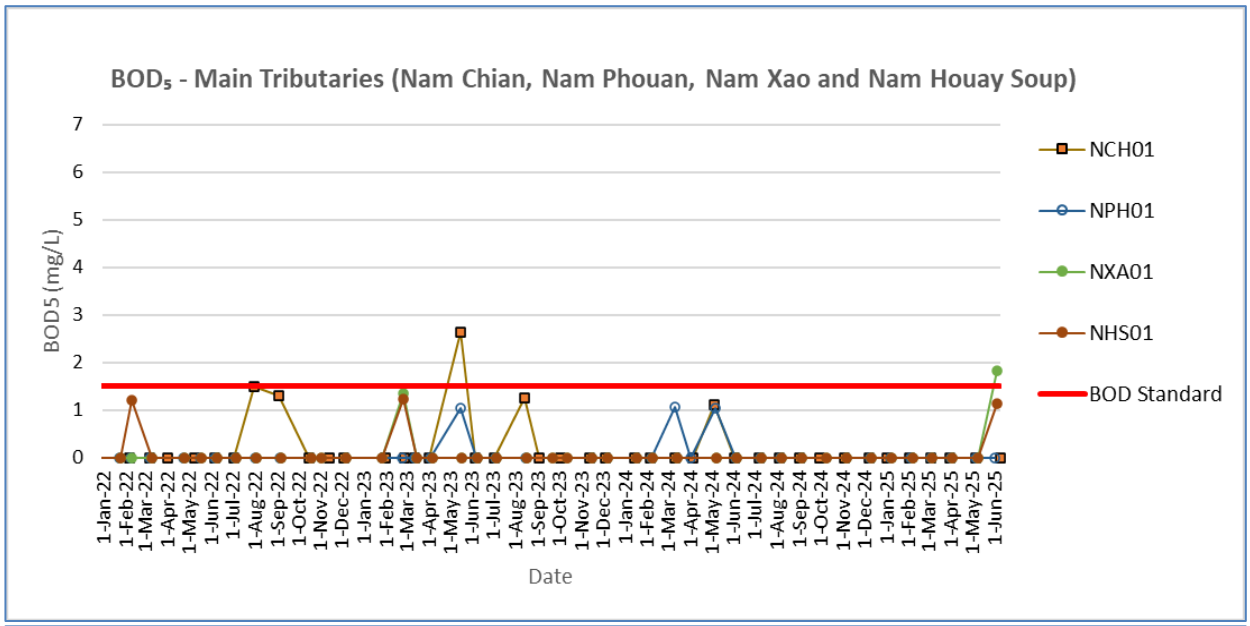


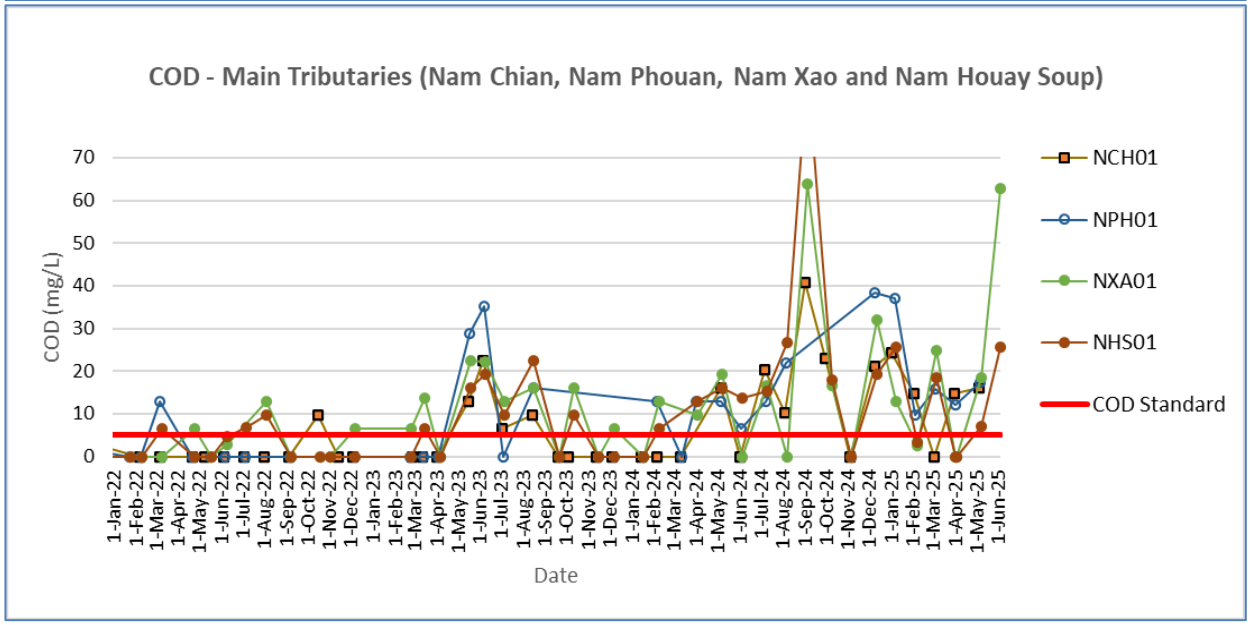




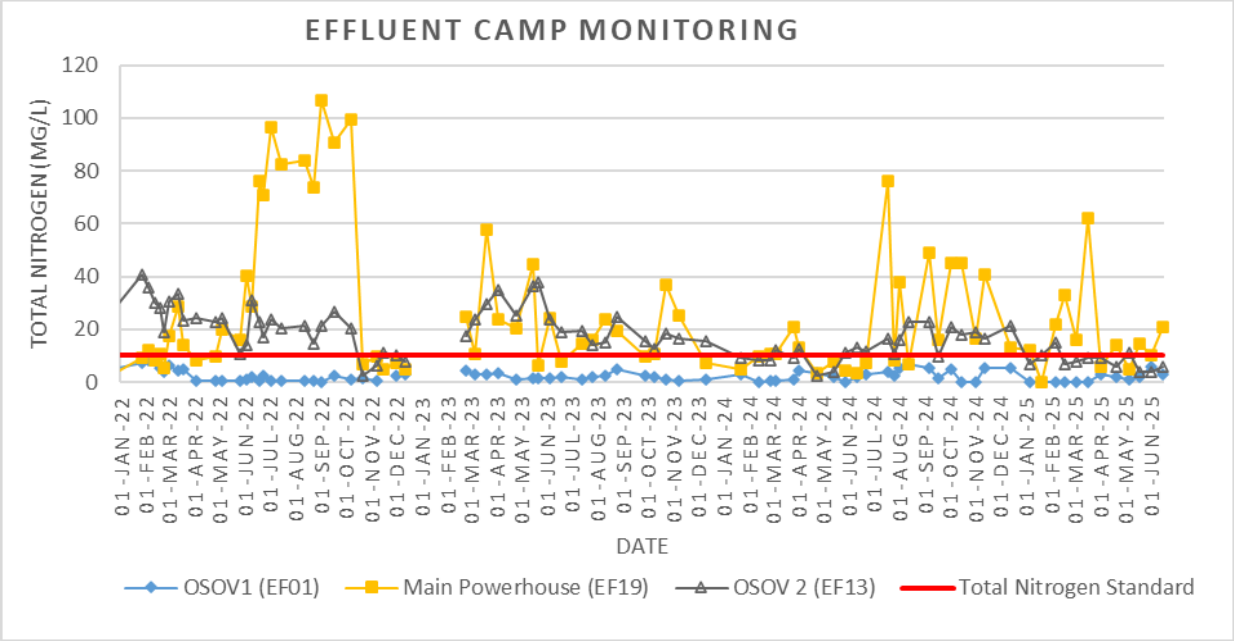
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

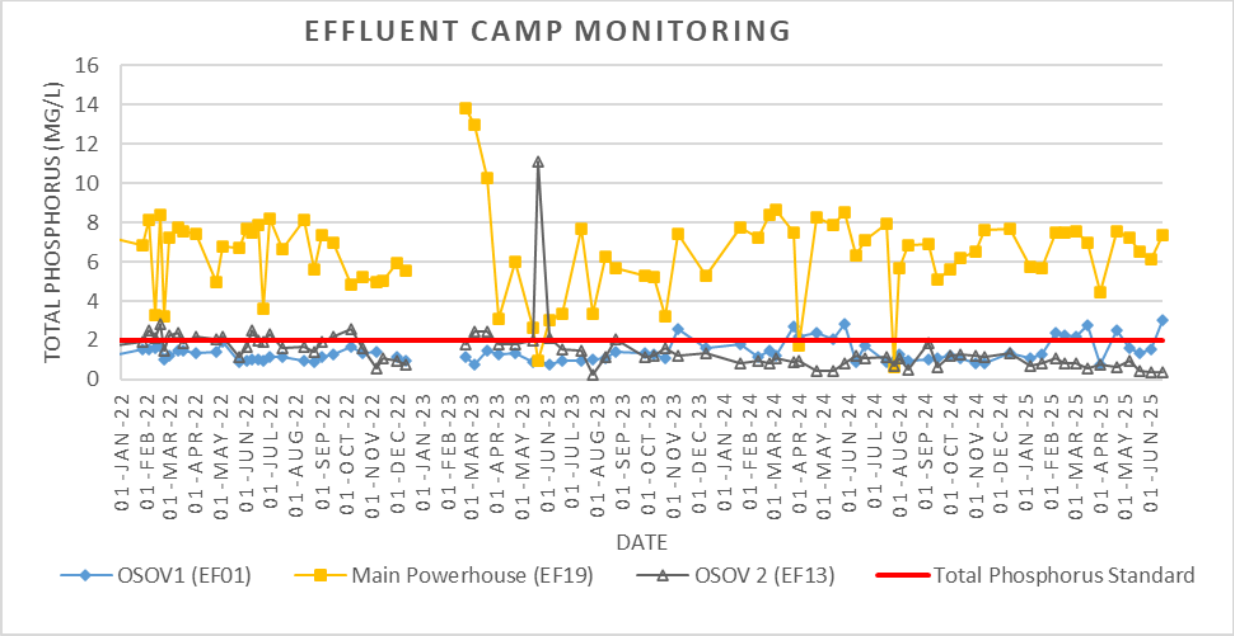


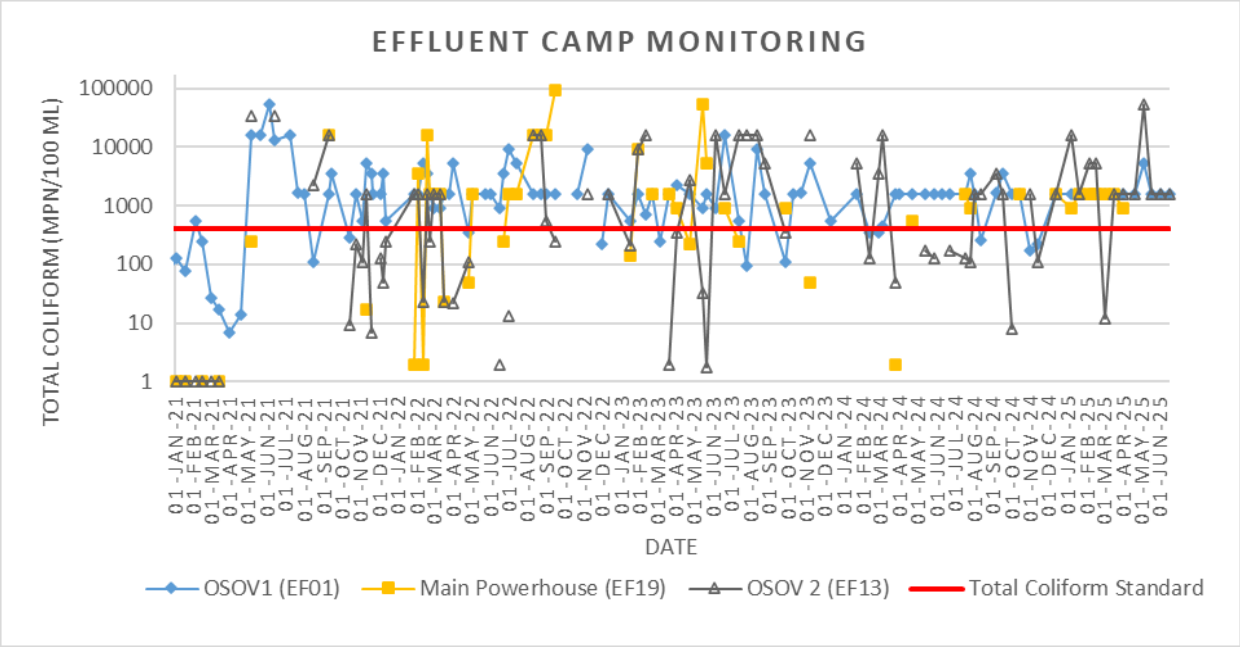

BOD₅ - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
BOD5 (mg/L)
Date
NCH01
NPH01
NXA01
NHS01
BOD Standard


COD - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
COD (mg/L)
Date
NCH01
NPH01
NXA01
NHS01
COD Standard

Camps' Effluent Water Quality Trends (Since January 2022 to June 2025)






EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
100000
10000
1000
100
10
1
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Coliform Standard

APPENDIX 5: WATER QUALITY MONITORING DATA

APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q2 2025

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-25	pH	5.0 - 9.0	6.7												7.42			
2-Apr-25	pH	5.0 - 9.0		7.44	7.33	7.21										7.26		
3-Apr-25	pH	5.0 - 9.0					7.18	7.69	7	7.37								
4-Apr-25	pH	5.0 - 9.0									7.17	7.04	6.45	6.83			6.61	7.33
9-Apr-25	pH	5.0 - 9.0		6.97	7.15	6.84	6.95											
10-Apr-25	pH	5.0 - 9.0						6.89	7.14	7.17								
22-Apr-25	pH	5.0 - 9.0		7.42	7.75	8.05	8.22											
23-Apr-25	pH	5.0 - 9.0						8.41	7.21	7.07								
29-Apr-25	pH	5.0 - 9.0		7.43	7.45	8.04												
30-Apr-25	pH	5.0 - 9.0					7.54	7.52	7.48	7.49								
6-May-25	pH	5.0 - 9.0	6.91												6.76			
7-May-25	pH	5.0 - 9.0		7.17	7.75	7.48										7.21		
8-May-25	pH	5.0 - 9.0					7.72	7.6	6.9	7.1								
9-May-25	pH	5.0 - 9.0									7.06	7.43	7.2	7.34			6.97	7.01
13-May-25	pH	5.0 - 9.0		6.9	7.21	7.74	7.42											
14-May-25	pH	5.0 - 9.0						7.7	6.5	6.9								
20-May-25	pH	5.0 - 9.0		7.98	8.08	8.37	8.03											
21-May-25	pH	5.0 - 9.0						8.1	8.1	8.1								
27-May-25	pH	5.0 - 9.0		7.86	8.18	8.34	8.2											
28-May-25	pH	5.0 - 9.0						7.86	6.9	6.9								
3-Jun-25	pH	5.0 - 9.0		7.72	7.92	7.82										7.59		
4-Jun-25	pH	5.0 - 9.0					7.75	7.81	6.86	7.6								
5-Jun-25	pH	5.0 - 9.0									7.04	6.99	7.8	7.34			6.92	7.47
10-Jun-25	pH	5.0 - 9.0	7.7												7.82			
11-Jun-25	pH	5.0 - 9.0		7.88	7.98	8.28	8.08											
12-Jun-25	pH	5.0 - 9.0						7.72	7.04	7.7								

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
17-Jun-25	pH	5.0 - 9.0		7.99	8.21	8.42	8.09											
18-Jun-25	pH	5.0 - 9.0						7.87	7.27	7.7								
24-Jun-25	pH	5.0 - 9.0			8.2	8.37	8.12	8.25										
25-Jun-25	pH	5.0 - 9.0							7.21	7.8	7.31							
1-Apr-25	Sat. DO (%)		82.5												103.9			
2-Apr-25	Sat. DO (%)			101.9	111.3	114.4										107.8		
3-Apr-25	Sat. DO (%)						91.8	92.6	44.2	50.2								
4-Apr-25	Sat. DO (%)										71.8	79.7	77.3	86.9			99.8	79.5
9-Apr-25	Sat. DO (%)			83.4	107.3	113.3	110.2											
10-Apr-25	Sat. DO (%)							95.2	40.8	40.6								
22-Apr-25	Sat. DO (%)			93.9	115.1	111.9	110.8											
23-Apr-25	Sat. DO (%)							111.2	61.9	58.9								
29-Apr-25	Sat. DO (%)			97.1	108.1	114.8												
30-Apr-25	Sat. DO (%)						93.8	96.7	51.2	48.2								
6-May-25	Sat. DO (%)		104.7												112.7			
7-May-25	Sat. DO (%)			88.23	112.4	112.5										100.82		
8-May-25	Sat. DO (%)						108.1	110.8	60.9	63								
9-May-25	Sat. DO (%)										96.2	84.85	79.44	78.69			76.79	77.46
13-May-25	Sat. DO (%)			89.1	103.8	110.4	108											
14-May-25	Sat. DO (%)							107.9	21.7	25.8								
20-May-25	Sat. DO (%)			87.3	110.5	115.7	105.9											
21-May-25	Sat. DO (%)							107.9	50.9	50.7								
27-May-25	Sat. DO (%)			84.2	109.5	113.2	109.1											
28-May-25	Sat. DO (%)							106.9	17.3	22.8								
3-Jun-25	Sat. DO (%)			90.7	113.6	110.1										101.4		
4-Jun-25	Sat. DO (%)						104.4	106.3	27.6	34.3								
5-Jun-25	Sat. DO (%)										42.7	53.6	69.3	70.1			87.1	84.3
10-Jun-25	Sat. DO (%)		88.9												104.2			
11-Jun-25	Sat. DO (%)			79.8	106.1	118.5	106.8											

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
12-Jun-25	Sat. DO (%)							107	16.2	19.4								
17-Jun-25	Sat. DO (%)			84.3	118	119.7	108.1											
18-Jun-25	Sat. DO (%)							102.8	17.3	22								
24-Jun-25	Sat. DO (%)				105.9	111.1	108.2	98.3										
25-Jun-25	Sat. DO (%)								24.9	32.2	52.3							
1-Apr-25	DO (mg/L)	>6.0	7.25												9.38			
2-Apr-25	DO (mg/L)	>6.0		8.44	9.05	9.34										9.39		
3-Apr-25	DO (mg/L)	>6.0					7.53	7.65	3.71	4.13								
4-Apr-25	DO (mg/L)	>6.0									6.24	6.65	6.53	7.21			8.03	6.83
9-Apr-25	DO (mg/L)	>6.0		6.88	8.02	8.83	8.72											
10-Apr-25	DO (mg/L)	>6.0						7.57	3.45	3.4								
22-Apr-25	DO (mg/L)	>6.0		6.98	8.18	8.08	8.14											
23-Apr-25	DO (mg/L)	>6.0						8.24	4.69	4.41								
29-Apr-25	DO (mg/L)	>6.0		7.75	7.98	8.27												
30-Apr-25	DO (mg/L)	>6.0					7.08	7.33	4.23	4.08								
6-May-25	DO (mg/L)	>6.0	8.75												9.42			
7-May-25	DO (mg/L)	>6.0		6.61	8	7.97										7.53		
8-May-25	DO (mg/L)	>6.0					7.71	8.1	4.6	4.7								
9-May-25	DO (mg/L)	>6.0									7	6.18	5.65	5.55			5.59	5.5
13-May-25	DO (mg/L)	>6.0		7.07	7.5	7.93	7.66											
14-May-25	DO (mg/L)	>6.0						7.9	1.8	2.1								
20-May-25	DO (mg/L)	>6.0		6.79	8.06	8.33	7.65											
21-May-25	DO (mg/L)	>6.0						4.1	4.1	4.1								
27-May-25	DO (mg/L)	>6.0		6.68	8	8.24	7.94											
28-May-25	DO (mg/L)	>6.0						8	1.4	1.8								
3-Jun-25	DO (mg/L)	>6.0		7.02	8.2	7.92										7.49		
4-Jun-25	DO (mg/L)	>6.0					7.57	7.9	2.2	2.7								
5-Jun-25	DO (mg/L)	>6.0									3.43	4.25	5.41	5.49			6.85	6.63
10-Jun-25	DO (mg/L)	>6.0	6.84												7.97			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
11-Jun-25	DO (mg/L)	>6.0		6.23	7.7	8.53	7.72											
12-Jun-25	DO (mg/L)	>6.0						7.7	1.3	1.5								
17-Jun-25	DO (mg/L)	>6.0		6.49	8.4	8.48	7.74											
18-Jun-25	DO (mg/L)	>6.0						7.5	1.4	1.7								
24-Jun-25	DO (mg/L)	>6.0			7.8	8.09	7.82	7.2										
25-Jun-25	DO (mg/L)	>6.0							2.0	2.5								
1-Apr-25	Conductivity (µs/cm)		186												111			
2-Apr-25	Conductivity (µs/cm)			161	90	79										80		
3-Apr-25	Conductivity (µs/cm)						78	78	85	83								
4-Apr-25	Conductivity (µs/cm)										86	85	85	84			396	63
9-Apr-25	Conductivity (µs/cm)			134	89	78	78											
10-Apr-25	Conductivity (µs/cm)							78	82	82								
22-Apr-25	Conductivity (µs/cm)			124.3	96.1	74.8	72.1											
23-Apr-25	Conductivity (µs/cm)							70.9	75.6	77.6								
29-Apr-25	Conductivity (µs/cm)			75.9	100.7	74.3												
30-Apr-25	Conductivity (µs/cm)						77	77	83	83								
6-May-25	Conductivity (µs/cm)		123												36			
7-May-25	Conductivity (µs/cm)			120	101.1	75.4										70		
8-May-25	Conductivity (µs/cm)						74.8	71.9	74.3	77.4								
9-May-25	Conductivity (µs/cm)										70	80	80	80			220	51
13-May-25	Conductivity (µs/cm)			87.2	101	75.7	74.8											
14-May-25	Conductivity (µs/cm)							69.4	67.9	69.2								
20-May-25	Conductivity (µs/cm)			93.4	98	75.3	73.6											
21-May-25	Conductivity (µs/cm)							69.8	69.5	69.3								
27-May-25	Conductivity (µs/cm)			97.5	94.4	75.9	72.8											
28-May-25	Conductivity (µs/cm)							66.5	68.1	67.9								
3-Jun-25	Conductivity (µs/cm)			87.8	95.3	79.3										143.6		
4-Jun-25	Conductivity (µs/cm)						73	67.3	68.3	70.1								
5-Jun-25	Conductivity (µs/cm)										70	74	104	82			110	19

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir					Re-Regulation Reservoir/Within		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
10-Jun-25	Conductivity (µs/cm)		161												70			
11-Jun-25	Conductivity (µs/cm)			73.4	94	81.2	75.4											
12-Jun-25	Conductivity (µs/cm)							70.3	72.3	74.6								
17-Jun-25	Conductivity (µs/cm)			85.8	91.1	82.2	74											
18-Jun-25	Conductivity (µs/cm)							68.7	76.1	76.9								
24-Jun-25	Conductivity (µs/cm)				86.1	77.2	71.7	71.2										
25-Jun-25	Conductivity (µs/cm)								75.7	75.4	75.1							
1-Apr-25	Temperature (°C)		21.75												20.31			
2-Apr-25	Temperature (°C)			24.49	25.85	25.57										22.17		
3-Apr-25	Temperature (°C)						25.4	24.94	24.1	25.26								
4-Apr-25	Temperature (°C)										23.54	24.13	23.74	24.66			26.32	22.9
9-Apr-25	Temperature (°C)			25.1	30.31	28.23	27.08											
10-Apr-25	Temperature (°C)							27.08	23.4	24.2								
22-Apr-25	Temperature (°C)			28.65	31.21	30.48	29.49											
23-Apr-25	Temperature (°C)							28.96	28.24	29.03								
29-Apr-25	Temperature (°C)			24.94	29.34	30.48												
30-Apr-25	Temperature (°C)						30.01	29.73	25	24.6								
6-May-25	Temperature (°C)		24.27												24.3			
7-May-25	Temperature (°C)			28.14	30.9	31.45										28.07		
8-May-25	Temperature (°C)						31.06	29.8	27.9	29.2								
9-May-25	Temperature (°C)										30.89	30.85	32.28	32.73			30.9	32.33
14-May-25	Temperature (°C)			25.19	30.1	30.69	31.31											
15-May-25	Temperature (°C)							29.4	24.1	24.4								
20-May-25	Temperature (°C)			26.14	29.73	30.37	30.27											
21-May-25	Temperature (°C)							29.3	25.5	25.4								
27-May-25	Temperature (°C)			25.22	29.5	29.98	29.86											
28-May-25	Temperature (°C)							28.7	24.37	24.9								
3-Jun-25	Temperature (°C)			26.31	30.2	30.48										28.74		
4-Jun-25	Temperature (°C)						30.07	28.9	25.03	26.2								

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir					Re-Regulation Reservoir/Within		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
5-Jun-25	Temperature (°C)										25.37	26.14	27.06				26.4	26.48
10-Jun-25	Temperature (°C)		26.44												26.66			
11-Jun-25	Temperature (°C)			25.69	29.5	30.35	30.11											
12-Jun-25	Temperature (°C)							30	25.55	26.4								
17-Jun-25	Temperature (°C)			26.74	31	31.32	30.76											
18-Jun-25	Temperature (°C)							29.5	25.58	26.1								
24-Jun-25	Temperature (°C)				29	29.76	30.08	29.3										
25-Jun-25	Temperature (°C)								26.22	26.9		26.53						
1-Apr-25	Turbidity (NTU)		10.5												1.94			
2-Apr-25	Turbidity (NTU)			52.8	3.21	2.1										52		
3-Apr-25	Turbidity (NTU)						2.14	1.41	2.76	2.77								
4-Apr-25	Turbidity (NTU)										2.4	2.97	2.89	6.33			3.13	8
9-Apr-25	Turbidity (NTU)			155	3.68	2.53	2.9											
10-Apr-25	Turbidity (NTU)							3.05	2.53	2.96								
22-Apr-25	Turbidity (NTU)			122	5.7	2.55	4.26											
23-Apr-25	Turbidity (NTU)							5.17	4.92	12.3								
29-Apr-25	Turbidity (NTU)			205	4.45	4.04												
30-Apr-25	Turbidity (NTU)						6.29	3.49	2.4	9.72								
6-May-25	Turbidity (NTU)		83.3												55.8			
7-May-25	Turbidity (NTU)			1.2	3.13	3.9										38.7		
8-May-25	Turbidity (NTU)						4.43	2.84	2.25	14.1								
9-May-25	Turbidity (NTU)										8.2	10.7	6.69	11.7			24.5	7.12
13-May-25	Turbidity (NTU)			165	61.8	10.2	3.74											
14-May-25	Turbidity (NTU)							2.9	1.99	4.03								
20-May-25	Turbidity (NTU)			240	5.02	4.91	3.76											
21-May-25	Turbidity (NTU)							2.34	4.21	5.16								
27-May-25	Turbidity (NTU)			211	5.1	4.13	3.2											
28-May-25	Turbidity (NTU)							2.6	2.84	3.25								
3-Jun-25	Turbidity (NTU)			172	4.4	3.01										16.6		

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir					Re-Regulation Reservoir/Within		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
4-Jun-25	Turbidity (NTU)						4.31	2.21	3.02	3.1								
5-Jun-25	Turbidity (NTU)										24.8	286	53				660	64.3
10-Jun-25	Turbidity (NTU)		3.68												44			
11-Jun-25	Turbidity (NTU)			568	15.5	2.96	3.02											
12-Jun-25	Turbidity (NTU)							4.19	3.87	2.96								
17-Jun-25	Turbidity (NTU)			214	9.62	3.06	3.02											
18-Jun-25	Turbidity (NTU)							2.21	4.27	4								
24-Jun-25	Turbidity (NTU)				4.23	2.76	3.46	3.92										
25-Jun-25	Turbidity (NTU)								6.99	10.9	13							
1-Apr-25	TSS (mg/L)		5.71												<5			
2-Apr-25	TSS (mg/L)			28.6		<5										166.8		
3-Apr-25	TSS (mg/L)						<5	<5	<5	<5								
4-Apr-25	TSS (mg/L)										<5	<5	<5	7.9			<5	<5
6-May-25	TSS (mg/L)		57.2												24			
7-May-25	TSS (mg/L)			76.53		<5										83.8		
8-May-25	TSS (mg/L)						<5	<5	<5	5.26								
9-May-25	TSS (mg/L)										<5	5	<5	5.81			13.6	<5
3-Jun-25	TSS (mg/L)			179.13		<5										50.23		
4-Jun-25	TSS (mg/L)						<5	<5	<5	<5								
5-Jun-25	TSS (mg/L)										11.63	167.92	31.92	21.58			894	47.88
10-Jun-25	TSS (mg/L)		220												18.98			
1-Apr-25	BOD_5 (mg/L)	<1.5	<1												<1			
2-Apr-25	BOD_5 (mg/L)	<1.5		<1		<1										<1		
3-Apr-25	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
4-Apr-25	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
6-May-25	BOD_5 (mg/L)	<1.5	<1												<1			
7-May-25	BOD_5 (mg/L)	<1.5		<1		<1										<1		
8-May-25	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
9-May-25	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
3-Jun-25	BOD_5 (mg/L)	<1.5		<1		<1										<1		
4-Jun-25	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
5-Jun-25	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			1.83	1.13
10-Jun-25	BOD_5 (mg/L)	<1.5	2.61												<1			
1-Apr-25	COD (mg/L)	<5.0	18.5												14.7			
2-Apr-25	COD (mg/L)	<5.0														12.2		
3-Apr-25	COD (mg/L)	<5.0							12.2	1.9			<5	<5			<5	<5
4-Apr-25	COD (mg/L)	<5.0									<5	<5	<5	<5			<5	<5
6-May-25	COD (mg/L)	<5.0	16.0												16			
7-May-25	COD (mg/L)	<5.0														17.3		
8-May-25	COD (mg/L)	<5.0							13	8.32								
9-May-25	COD (mg/L)	<5.0									4.48	12.2	4.48	9.6			18.5	7.03
3-Jun-25	COD (mg/L)	<5.0																
4-Jun-25	COD (mg/L)	<5.0	17.0						8.96	7.68								
5-Jun-25	COD (mg/L)	<5.0									10.2	16.6	24.3	12.8			62.7	25.6
10-May-25	COD (mg/L)	<5.0																
1-Apr-25	NH_3-N (mg/L)	<0.2	<0.1												<0.1			
2-Apr-25	NH_3-N (mg/L)	<0.2		<0.1		<0.1										<0.1		
3-Apr-25	NH_3-N (mg/L)	<0.2					<0.1	<0.1										
6-May-25	NH_3-N (mg/L)	<0.2		<0.1											<0.1			
7-May-25	NH_3-N (mg/L)	<0.2		<0.1		<0.1										<0.1		
8-May-25	NH_3-N (mg/L)	<0.2					<0.1	<0.1										
3-Jun-25	NH_3-N (mg/L)	<0.2		<0.1		<0.1										<0.1		
4-Jun-25	NH_3-N (mg/L)	<0.2					<0.1	<0.1										
10-Jun-25	NH_3-N (mg/L)	<0.2																
1-Apr-25	NO_3-N (mg/L)	<5.0	0.47												0.14			
2-Apr-25	NO_3-N (mg/L)	<5.0		0.36		<0.05										0.05		
3-Apr-25	NO_3-N (mg/L)	<5.0					0.07	0.02										
6-May-25	NO_3-N (mg/L)	<5.0	0.28												0.16			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
7-May-25	NO_3-N (mg/L)	<5.0		0.39		0.09										0.05		
8-May-25	NO_3-N (mg/L)	<5.0					0.02	<0.05										
3-Jun-25	NO_3-N (mg/L)	<5.0		0.53		0.16										0.08		
4-Jun-25	NO_3-N (mg/L)	<5.0					0.06	0.06										
10-Jun-25	NO_3-N (mg/L)	<5.0																
1-Apr-25	Faecal coliform (MPN/100 mL)	<1,000	540												350			
2-Apr-25	Faecal coliform (MPN/100 mL)	<1,000														11		
3-Apr-25	Faecal coliform (MPN/100 mL)	<1,000						0	0	2								
4-Apr-25	Faecal coliform (MPN/100 mL)	<1,000									8	7	17	33			22	2
6-May-25	Faecal coliform (MPN/100 mL)	<1,000	920												920			
7-May-25	Faecal coliform (MPN/100 mL)	<1,000														11		
8-May-25	Faecal coliform (MPN/100 mL)	<1,000						8	0	11								
9-May-25	Faecal coliform (MPN/100 mL)	<1,000									220	350	70	70			170	540
3-Jun-25	Faecal coliform (MPN/100 mL)	<1,000														130		
4-Jun-25	Faecal coliform (MPN/100 mL)	<1,000						0	17	49								
5-Jun-25	Faecal coliform (MPN/100 mL)	<1,000									34	34	34	130			350	240
10-Jun-25	Faecal coliform (MPN/100 mL)	<1,000	1,600												1,600			
1-Apr-25	Total Coliform (MPN/100 mL)	<5,000	920												540			
2-Apr-25	Total Coliform (MPN/100 mL)	<5,000														33		
3-Apr-25	Total Coliform (MPN/100 mL)	<5,000						0	5	5								
4-Apr-25	Total Coliform (MPN/100 mL)	<5,000									8	11	33	110			26	17
6-May-25	Total Coliform (MPN/100 mL)	<5,000	920												920			
7-May-25	Total Coliform (MPN/100 mL)	<5,000														39		
8-May-25	Total Coliform (MPN/100 mL)	<5,000						22	5	17								
9-May-25	Total Coliform (MPN/100 mL)	<5,000									1,600	1,600	170	350			540	1,600
3-Jun-25	Total Coliform (MPN/100 mL)	<5,000														1,600		
4-Jun-25	Total Coliform (MPN/100 mL)	<5,000						0	34	220								
5-Jun-25	Total Coliform (MPN/100 mL)	<5,000									280	920	1,600	920			1,600	1,600
10-Jun-25	Total Coliform (MPN/100 mL)	<5,000	1,600												280			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-25	TKN		<5												<5			
2-Apr-25	TKN			<5		<5										<5		
3-Apr-25	TKN						<5	1								<5		
6-May-25	TKN		<5												<5			
7-May-25	TKN			<5		<5										<5		
8-May-25	TKN						<5	1										
3-Jun-25	TKN			1		1										1		
4-Jun-25	TKN						1	1										
10-Jun-25	TKN																	
1-Apr-25	TOC (mg/L)		5.45												5.66			
2-Apr-25	TOC (mg/L)															5.8		
3-Apr-25	TOC (mg/L)								5.04	4.98								
4-Apr-25	TOC (mg/L)										5.14	5.75	5.21	5.25			5.64	6.13
6-May-25	TOC (mg/L)		5.03												6.11			
7-May-25	TOC (mg/L)															5.06		
8-May-25	TOC (mg/L)								5.44	4.77								
9-May-25	TOC (mg/L)										5.3	5.46	5.22	4.67			7.18	7.1
3-Jun-25	TOC (mg/L)															7.77		
4-Jun-25	TOC (mg/L)								7.58	7.45								
10-Jun-25	TOC (mg/L)										9.74	8.66	9.54	8.13			13.92	15.93
1-Apr-25	Total Phosphorus (mg/L)		0.09												0.2			
2-Apr-25	Total Phosphorus (mg/L)			0.09		0.05										0.11		
3-Apr-25	Total Phosphorus (mg/L)						0.05	0.07										
6-May-25	Total Phosphorus (mg/L)		0.28												0.39			
7-May-25	Total Phosphorus (mg/L)			0.16		0.1										0.1		
8-May-25	Total Phosphorus (mg/L)						0.16	0.06										
3-Jun-25	Total Phosphorus (mg/L)			0.17		0.11										0.17		
4-Jun-25	Total Phosphorus (mg/L)						0.25	0.13										
10-Jun-25	Total Phosphorus (mg/L)																	

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-25	Total Dissolved Phosphorus (mg/L)		0.08												0.07			
2-Apr-25	Total Dissolved Phosphorus (mg/L)			0.06		0.07										0.07		
3-Apr-25	Total Dissolved Phosphorus (mg/L)						0.07	0.04										
6-May-25	Total Dissolved Phosphorus (mg/L)		0.1												0.11			
7-May-25	Total Dissolved Phosphorus (mg/L)			0.08		0.08										0.1		
8-May-25	Total Dissolved Phosphorus (mg/L)						0.07	0.07										
3-Jun-25	Total Dissolved Phosphorus (mg/L)			0.11		0.11										0.12		
4-Jun-25	Total Dissolved Phosphorus (mg/L)						0.07	0.08										
10-Jun-25	Total Dissolved Phosphorus (mg/L)																	
2-Apr-25	Turbidity (NTU)-bottom					3.87												
3-Apr-25	Turbidity (NTU)-bottom						4.14	12.6										
7-May-25	Turbidity (NTU)-bottom					15.6												
8-May-25	Turbidity (NTU)-bottom						1.84	1.78										
3-Jun-25	Turbidity (NTU)-bottom					5.3												
4-Jun-25	Turbidity (NTU)-bottom						3.5	3.32										
2-Apr-25	TSS (mg/L)-bottom					<5												
3-Apr-25	TSS (mg/L)-bottom						<5	<5										
7-May-25	TSS (mg/L)-bottom					<5												
8-May-25	TSS (mg/L)-bottom						<5	<5										
3-Jun-25	TSS (mg/L)-bottom					<5												
4-Jun-25	TSS (mg/L)-bottom						<5	<5										
2-Apr-25	BOD_5 (mg/L)-bottom					<1												
3-Apr-25	BOD_5 (mg/L)-bottom						<1	<1										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
7-May-25	BOD_5 (mg/L)-bottom					<1												
8-May-25	BOD_5 (mg/L)-bottom						<1	<1										
3-Jun-25	BOD_5 (mg/L)-bottom					<1												
4-Jun-25	BOD_5 (mg/L)-bottom						4.74	<1										
8-May-25	Total Coliform (MPN/100 mL)-bottom							920										
4-Jun-25	Total Coliform (MPN/100 mL)-bottom							0										
8-May-25	Faecal coliform (MPN/100 mL)-bottom							170										
4-Jun-25	Faecal coliform (MPN/100 mL)-bottom							0										
2-Apr-25	NH_3-N (mg/L)-bottom					<0.1												
3-Apr-25	NH_3-N (mg/L)-bottom						<0.1	<0.1										
7-May-25	NH_3-N (mg/L)-bottom					<0.1												
8-May-25	NH_3-N (mg/L)-bottom						<0.1	<0.1										
2-Apr-25	NO_3-N (mg/L)-bottom					0.18												
3-Apr-25	NO_3-N (mg/L)-bottom						<0.05	<0.05										
7-May-25	NO_3-N (mg/L)-bottom					0.05												
8-May-25	NO_3-N (mg/L)-bottom						<0.05	<0.05										
2-Apr-25	TKN-bottom					<5												
3-Apr-25	TKN-bottom						1	<5										
7-May-25	TKN-bottom					<5												
8-May-25	TKN-bottom						<5	1										
3-Jun-25	TKN-bottom					<5												
4-Jun-25	TKN-bottom						1	1										
2-Apr-25	Total Dissolved Phosphorus (mg/L)-bottom					0.06												
3-Apr-25	Total Dissolved Phosphorus (mg/L)-bottom						0.06	0.06										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
7-May-25	Total Dissolved Phosphorus (mg/L)-bottom					0.11												
8-May-25	Total Dissolved Phosphorus (mg/L)-bottom						0.12	0.12										
3-Jun-25	Total Dissolved Phosphorus (mg/L)-bottom					0.05												
4-Jun-25	Total Dissolved Phosphorus (mg/L)-bottom						0.06	0.11										
2-Apr-25	Total Phosphorus (mg/L)-bottom					0.05												
3-Apr-25	Total Phosphorus (mg/L)-bottom						0.14	0.1										
7-May-25	Total Phosphorus (mg/L)-bottom					0.38												
8-May-25	Total Phosphorus (mg/L)-bottom						0.08	0.09										
3-Jun-25	Total Phosphorus (mg/L)-bottom					0.14												
4-Jun-25	Total Phosphorus (mg/L)-bottom						0.05	0.14										
2-Apr-25	Chlorophyll-A-bottom					0.0006												
3-Apr-25	Chlorophyll-A-bottom						0.0004	0.001										
7-May-25	Chlorophyll-A-bottom					0.0005												
8-May-25	Chlorophyll-A-bottom						0.0007	0.0012										
3-Jun-25	Chlorophyll-A-bottom					0.0018												
4-Jun-25	Chlorophyll-A-bottom						0.0002	0.0006										
2-Apr-25	Chlorophyll-A			0.0016		0.0008												
3-Apr-25	Chlorophyll-A						0.0006	0.0006										
7-May-25	Chlorophyll-A			0.0016		0.0012												
8-May-25	Chlorophyll-A						0.0008	0.0006										
3-Jun-25	Chlorophyll-A			0.0025		0.0004												

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q2 2025

		Site Name	OSOV1 (Owner's Site Office and Village)	OSOV2 (ESD Camp)	Main Powerhouse
		Station Code	EF01	EF13	EF19
		Date			
Date	Parameters (Unit)	Guideline in the CA			
1-Apr-25	pH	6.0 - 9.0	7.02	7.27	7.24
21-Apr-25	pH	6.0 - 9.0	6.86	6.93	6.61
6-May-25	pH	6.0 - 9.0	6.89	6.67	6.61
19-May-25	pH	6.0 - 9.0	6.98	7.57	7.84
2-Jun-25	pH	6.0 - 9.0	6.84	6.87	7.66
16-Jun-25	pH	6.0 - 9.0	7.12	7.33	7.97
1-Apr-25	Sat. DO (%)		52.6	107.5	74.2
21-Apr-25	Sat. DO (%)		46.2	92.5	67.9
6-May-25	Sat. DO (%)		55.6	86.1	89.2
19-May-25	Sat. DO (%)		33.5	97.6	53.8
2-Jun-25	Sat. DO (%)		26.8	91.4	51.6
16-Jun-25	Sat. DO (%)		39.8	96.8	46.1
1-Apr-25	DO (mg/L)		4.18	8.58	5.71
21-Apr-25	DO (mg/L)		3.72	7.38	5.13
6-May-25	DO (mg/L)		4.25	6.65	6.66
19-May-25	DO (mg/L)		2.43	7.16	3.78
2-Jun-25	DO (mg/L)		1.95	6.53	3.73
16-Jun-25	DO (mg/L)		2.95	7.22	3.69
1-Apr-25	Conductivity (µs/cm)		419	309	1,124
21-Apr-25	Conductivity (µs/cm)		260	258	1,002
6-May-25	Conductivity (µs/cm)		321	355	1,005
19-May-25	Conductivity (µs/cm)		247	307	656
2-Jun-25	Conductivity (µs/cm)		349	223	793
16-Jun-25	Conductivity (µs/cm)		282	261	864
1-Apr-25	Temperature (°C)		27.74	26.78	28.65
21-Apr-25	Temperature (°C)		28.67	27.68	29.73
6-May-25	Temperature (°C)		29.88	28.48	30.43
19-May-25	Temperature (°C)		30.42	29.83	31.85
2-Jun-25	Temperature (°C)		30.19	31.09	30.72
16-Jun-25	Temperature (°C)		28.75	28.99	29.94
1-Apr-25	Turbidity (NTU)		1.68	6.26	7.3
21-Apr-25	Turbidity (NTU)		2.85	6.31	15.6
6-May-25	Turbidity (NTU)		1.69	7.16	15.1
19-May-25	Turbidity (NTU)		1.81	5.98	6
2-Jun-25	Turbidity (NTU)		1.9	7.7	6.6

		Site Name	OSOV1 (Owner's Site Office and Village)	OSOV2 (ESD Camp)	Main Powerhouse
		Station Code	EF01	EF13	EF19
		Date			
Date	Parameters (Unit)	Guideline in the CA			
16-Jun-25	Turbidity (NTU)		3.66	6.28	7.16
1-Apr-25	TSS (mg/L)	<50	6.4	13.33	8.8
21-Apr-25	TSS (mg/L)	<50	<5	<5	20.4
6-May-25	TSS (mg/L)	<50	<5	5.2	26.3
19-May-25	TSS (mg/L)	<50	7	6.66	6.4
2-Jun-25	TSS (mg/L)	<50	<5	<5	6.5
16-Jun-25	TSS (mg/L)	<50	<5	5.8	12.0
1-Apr-25	BOD_5 (mg/L)	<30	9.06	10.95	11.76
21-Apr-25	BOD_5 (mg/L)	<30	9.1	10.4	<6
6-May-25	BOD_5 (mg/L)	<30	<6	18.3	<6
19-May-25	BOD_5 (mg/L)	<30	8.4	7.86	<6
2-Jun-25	BOD_5 (mg/L)	<30	<6	<6	<6
16-Jun-25	BOD_5 (mg/L)	<30	<6	9	<6
1-Apr-25	COD (mg/L)	<125	0.64	19	76
21-Apr-25	COD (mg/L)	<125	8.74	17	24
6-May-25	COD (mg/L)	<125	9.6	21	29
19-May-25	COD (mg/L)	<125	3.2	13	25
2-Jun-25	COD (mg/L)	<125	11.5	90	35
16-Jun-25	COD (mg/L)	<125	6.72	14	20
1-Apr-25	NH_3-N (mg/L)	<10.0	<0.1	0.34	0.2
21-Apr-25	NH_3-N (mg/L)	<10.0	0.01	0.09	0.2
6-May-25	NH_3-N (mg/L)	<10.0	<0.1	0.31	0.3
19-May-25	NH_3-N (mg/L)	<10.0	0.05	0.23	0.5
2-Jun-25	NH_3-N (mg/L)	<10.0	0.10	0.18	0.3
16-Jun-25	NH_3-N (mg/L)	<10.0	0.11	0.21	0.3
1-Apr-25	Total Nitrogen (mg/L)	<10.0	3.00	9.00	6.0
21-Apr-25	Total Nitrogen (mg/L)	<10.0	2.00	6.00	14.0
6-May-25	Total Nitrogen (mg/L)	<10.0	1.00	11.00	5.0
19-May-25	Total Nitrogen (mg/L)	<10.0	2.00	4.00	14.6
2-Jun-25	Total Nitrogen (mg/L)	<10.0	6.00	4.00	10.0
16-Jun-25	Total Nitrogen (mg/L)	<10.0	3.00	6.00	21.0
1-Apr-25	Total Phosphorus (mg/L)	<2	0.78	0.74	4.4
21-Apr-25	Total Phosphorus (mg/L)	<2	2.5	0.61	7.5
6-May-25	Total Phosphorus (mg/L)	<2	1.62	0.93	7.2
19-May-25	Total Phosphorus (mg/L)	<2	1.33	0.47	6.6
2-Jun-25	Total Phosphorus (mg/L)	<2	1.53	0.37	6.1

		Site Name	OSOV1 (Owner's Site Office and Village)	OSOV2 (ESD Camp)	Main Powerhouse
		Station Code	EF01	EF13	EF19
		Date			
Date	Parameters (Unit)	Guideline in the CA			
16-Jun-25	Total Phosphorus (mg/L)	<2	3	0.38	7.4
1-Apr-25	Oil & Grease (mg/L)	<10.0	<2	<2	2
21-Apr-25	Oil & Grease (mg/L)	<10.0	0.8	<2	2
6-May-25	Oil & Grease (mg/L)	<10.0	<2	<2	<2
19-May-25	Oil & Grease (mg/L)	<10.0	2.1	<2	<2
2-Jun-25	Oil & Grease (mg/L)	<10.0	<2	<2	<2
16-Jun-25	Oil & Grease (mg/L)	<10.0	<2	2	2
1-Apr-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	920
21-Apr-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
6-May-25	Total coliform (MPN/100 mL)	<400	5,400	54,000	0
19-May-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
2-Jun-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
16-Jun-25	Total coliform (MPN/100 mL)	<400	1,600	1,600	0
1-Apr-25	Faecal Coliform (MPN/100 mL)	<400	920	1,600	540
21-Apr-25	Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	0
6-May-25	Faecal Coliform (MPN/100 mL)	<400	3,500	16,000	0
19-May-25	Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	0
2-Jun-25	Faecal Coliform (MPN/100 mL)	<400	920	1,600	0
16-Jun-25	Faecal Coliform (MPN/100 mL)	<400	1,600	540	0
1-Apr-25	Residual Chlorine (mg/L)	<1.0	N/A	0.04	0.13
21-Apr-25	Residual Chlorine (mg/L)	<1.0	N/A	0.03	1.26
6-May-25	Residual Chlorine (mg/L)	<1.0	N/A	0.06	1.95
19-May-25	Residual Chlorine (mg/L)	<1.0	N/A	0.16	1.21
2-Jun-25	Residual Chlorine (mg/L)	<1.0	N/A	0.55	0.40
16-Jun-25	Residual Chlorine (mg/L)	<1.0	N/A	0.08	0.31

APPENDIX 5-3: COMMUNITY GROUNDWATER QUALITY MONITORING RESULTS – Q2 2025

		Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Month Year	Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
01-Apr-25	pH	6.5 - 9.2				7.3	7.22
24-Apr-25	pH	6.5 - 9.2	7.18	7.01	6.98		
06-May-25	pH	6.5 - 9.2				7.02	
22-May-25	pH	6.5 - 9.2	7.72	7.56	7.64		
10-Jun-25	pH	6.5 - 9.2				7.26	6.8
23-Jun-25	pH	6.5 - 9.2	7.75	7.65	7.4		
01-Apr-25	Sat. DO (%)					83.4	53.1
24-Apr-25	Sat. DO (%)		76.1	76.1	68.3		
06-May-25	Sat. DO (%)					98.1	
22-May-25	Sat. DO (%)		86.9	89.8	82.6		
10-Jun-25	Sat. DO (%)					94.1	102.8
23-Jun-25	Sat. DO (%)		86.8	87	68.3		
01-Apr-25	DO (mg/l)					7.11	4.58
24-Apr-25	DO (mg/l)		5.74	5.79	5.21		
06-May-25	DO (mg/l)					7.87	
22-May-25	DO (mg/l)		6.64	6.83	6.26		
10-Jun-25	DO (mg/l)					7.18	7.87
23-Jun-25	DO (mg/l)		6.7	6.75	5.23		
01-Apr-25	Conductivity (µS/cm)					24	271
24-Apr-25	Conductivity (µS/cm)		471	442	473		
06-May-25	Conductivity (µS/cm)					27	
22-May-25	Conductivity (µS/cm)		460	389	388		
10-Jun-25	Conductivity (µS/cm)					80	110
23-Jun-25	Conductivity (µS/cm)		420	368	263		
01-Apr-25	Temperature (°C)					23.23	23.45
24-Apr-25	Temperature (°C)		29.94	28.2	29.44		
06-May-25	Temperature (°C)					26.53	
22-May-25	Temperature (°C)		27.7	27.93	28.11		
10-Jun-25	Temperature (°C)					26.79	26.68
23-Jun-25	Temperature (°C)		27.2	26.94	27.6		

		Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Month Year	Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
01-Apr-25	Turbidity (NTU)	<20				1.58	0.53
24-Apr-25	Turbidity (NTU)	<20	0.6	0.6	1.9		
06-May-25	Turbidity (NTU)	<20				2.31	
22-May-25	Turbidity (NTU)	<20	1.19	0.82	5.12		
10-Jun-25	Turbidity (NTU)	<20				5.09	1.17
23-Jun-25	Turbidity (NTU)	<20	0.72	1.32	2.89		
01-Apr-25	Fecal coliform (MPN/100ml)	0				0	0
24-Apr-25	Fecal coliform (MPN/100ml)	0	4.5	17	0		
06-May-25	Fecal coliform (MPN/100ml)	0				0	
22-May-25	Fecal coliform (MPN/100ml)	0	2	1.8	23		
10-Jun-25	Fecal coliform (MPN/100ml)	0				0	240
23-Jun-25	Fecal coliform (MPN/100ml)	0	0	24	0		
01-Apr-25	E.coli Bacteria (MPN/100ml)	0				0	0
24-Apr-25	E.coli Bacteria (MPN/100ml)	0	0	0	0		
06-May-25	E.coli Bacteria (MPN/100ml)	0				0	
22-May-25	E.coli Bacteria (MPN/100ml)	0	0	0	0		
10-Jun-25	E.coli Bacteria (MPN/100ml)	0				0	4.5
23-Jun-25	E.coli Bacteria (MPN/100ml)	0	0	2	0		

APPENDIX 5-4: GRAVITY FED WATER SUPPLY QUALITY MONITORING RESULTS – Q2 2025

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
24-Apr-25	pH	6.5 - 8.5	7.29	7.38	7.2	7.02
25-May-25	pH	6.5 - 8.5	7.65		8.13	7.81
23-Jun-25	pH	6.5 - 8.5	7.93	7.69	8.02	7.97
24-Apr-25	Sat. DO (%)		69	79.4	78.2	73.7
22-May-25	Sat. DO (%)		85.7		92.7	81.1
23-Jun-25	Sat. DO (%)		85.5	86.7	100.9	99.4
24-Apr-25	DO (mg/L)		5.46	4.18	6.04	5.65
22-May-25	DO (mg/L)		6.62		7.1	6.46
23-Jun-25	DO (mg/L)		6.66	6.76	7.87	7.88
24-Apr-25	Conductivity (µS/cm)	<1,000	151	75	20	21
22-May-25	Conductivity (µS/cm)	<1,000	72		15	14
23-Jun-25	Conductivity (µS/cm)	<1,000	50	248	13	23
24-Apr-25	Temperature (°C)	<35	27.37	28.25	28.73	28.65
22-May-25	Temperature (°C)	<35	27.32		27.69	27.45
23-Jun-25	Temperature (°C)	<35	26.9	26.71	26.51	25.75
24-Apr-25	Turbidity (NTU)	<10	6.19	2.31	4.83	3.86
22-May-25	Turbidity (NTU)	<10	2.47		10.4	11.9
23-Jun-25	Turbidity (NTU)	<10	4.46	2.37	6.45	5.76
24-Apr-25	Faecal Coliform (MPN/100 mL)	0	11	35	12	9.3
22-May-25	Faecal Coliform (MPN/100 mL)	0	4		1600	1600
23-Jun-25	Faecal Coliform (MPN/100 mL)	0	8	27	70	540
24-Apr-25	E.coli Bacteria (MPN/100 mL)	0	17	4.5	0	0
22-May-25	E.coli Bacteria (MPN/100 mL)	0	2		79	79
23-Jun-25	E.coli Bacteria (MPN/100 mL)	0	8	27	33	24

APPENDIX 5-5: LANDFILL LEACHATED QUALITY MONITORING RESULTS – Q2 2025

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
2-Jun-25	pH	6.0-9.0				8.43		8.4	
2-Jun-25	Sat. DO (%)					182.6		138	
2-Jun-25	DO (mg/L)					12.49		9.5	
2-Jun-25	Conductivity (µS/cm)					110		100	
2-Jun-25	Temperature (°C)					34.05		34.07	
2-Jun-25	Turbidity (NTU)					82.7		14.7	
2-Jun-25	BOD_5 (mg/L)	<30				17.7		<6	
2-Jun-25	COD (mg/L)	<125				87		35.8	
2-Jun-25	Faecal Coliform (MPN/100 mL)	<400				920		110	
2-Jun-25	Total Coliform (MPN/100 mL)	<400				920		920	
2-Jun-25	Total Nitrogen (mg/L)	<10				3		2	
2-Jun-25	Lead (mg/L)	<0.2				<0.01		<0.01	
2-Jun-25	Copper (mg/L)					<0.1		<0.1	
2-Jun-25	Iron (mg/L)					0.81		0.33	
2-Jun-25	Ammonia nitrogen (mg/L)	<10				<0.1		0.06	
2-Jun-25	Oil & Grease (mg/L)	<10				<2		1.1	

APPENDIX 6: DWP & SSESMMP FOR INVESTIGATION OF LEAKAGE PATH AT J27 AT THE MAIN DAM

DETAILED WORK PROGRAM

AND

SITE SPECIFIED ENVIRONMENT & SOCIAL MANAGEMENT

AND

MONITORING PLAN

FOR

INVESTIGATION OF LEAKAGE PATH AT J27

Nam Ngiep 1 Hydroelectric Power Project

Submitted By

Kenber Geotechnic (Thailand) Co., Ltd.

June 2025

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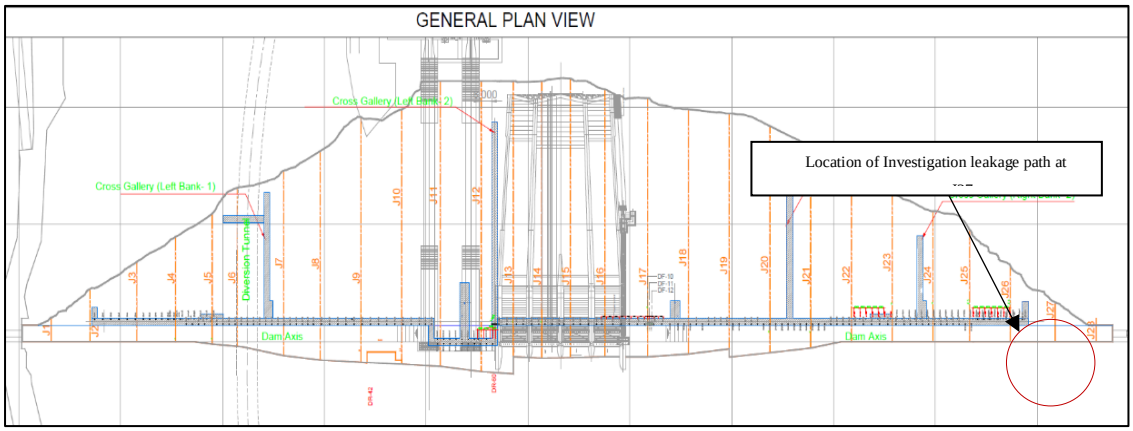
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A. Detailed Work Program (DWP) for Investigation of Leakage Path at J27

1. General

The investigation for leakage path at J27 on the upstream side at the right abutment of the main dam to inspect the leakage path from the upstream side to the downstream side at J27 of the dam. According to the information, the highest water impounding is caused for high water leakage, the drilling, the tracing test, and grouting shall be done to reduce the water leakage at the dam foundation.

The location of the additional drainage work is shown below.



2. Scope of Works

The high leakage has been recorded at J27, located at the high level of the right abutment. The foundation around J27 is the vertical cracks and steep slope from the upstream side to the downstream side along the mountain. The leakage comes from the foundation cracks that is this work will investigate the leakage path in the rock foundation and perform grouting to solve this issue. (The original scope of work set out in the SOW and Technical specification**.)**

The description for the investigation of leakage path at J27 is shown in the table below.

Item	Description	Unit	Quantity
A	**MOBILIZATION & DEMOBILIZATION WORK**		
A-1	Mobilization and Demobilization	LS	1.0
A-2	Temporary camp, site office	month	2.0
A-3	Site preparation at J27 work	LS	1
A-4	Rehabilitation and cleaning of concrete structure around working area (by Client)	LS	1
A-5	Rehabilitation and cleaning of concrete structure inside gallery (rate only)	LS	1
D	**Investigation of leakage path at J27**		
D-1	Rock cleaning work at reservoir area above water level using water jet (by Client)	m2	20
D-2	Drilling by 2m hand coring machine	m	20

D-3	Tracing test	nos	5
D-4	Cement Grouting Operation	ton	18
D-5	Cement Grouting Material (Type 1)	ton	18
D-6	Cement Grouting Material (Type 3) - rate only	ton	18
D-7	Admixture (equivalent to Rheobuild 1008)	l	43
D-8	Concrete with wire mesh (by Client)	m3	4
D-9	Formwork (by Client)	m2	6

3. Reference

- Technical Specification
- Scope of Works (SOW)
- General Design

4. Manpower

The main personnel for the execution of the investigation of leakage path at J27, as shown in the table below.

The organizational chart has been provided for this work in Appendix 2.

No.	Position	Number	Assignment
1.	Site Manager / Chief Engineer	1	Site Management
2.	Site Engineer/Safety Engineer	1	Site Supervision and Safety Control
3.	Mechanic / Electrician	2	Equipment Maintenance
4.	Driller	2	Drilling Works
5.	Grout Operator	1	Tracing Test and Grouting Works
6.	Skilled Worker/Common worker	6	Common Works

5. Materials

5.1 Cement

The cement used for remedial grouting is Portland Cement Type I, ASTM C150, in 50 kg/bag. Compatibility of cement with the admixtures shall undergo required laboratory tests before usage. Cement is used for grouting in tightly fractured rock where cracks are tight to take advantage of the finer grain size.

5.2 Water

The water to be used will come from Nam Ngiep river or a nearby water source. The water will be pumped to the settlement tank before use for mixing, cleaning, grouting. All the water will be stored in

storage, allowing the fine particles to settle and be kept cool for the grout mix. The water shall not contain large particles and the temperature of water shall be maintained below 30 ℃. It shall be checked during the execution of the works

5.3 Admixture

The admixture to be used for grout mixes is Rheobuild 1008 or equivalent, which are in accordance with the recommendation of the manufacturer's specification and material safety data sheet of admixture.

5.4 Trial Mixes

The stable grout mix portion shall be a stable mixture of fine cement, water, and admixture. The suitable grout mix shall be (W:C:A) 0.65–0.75 :1:0.5-1.0% of Rheobuild 1008 or equivalent.

The following grout mix is to be used as below.

Cement: Portland cement type I in conformance with ASTM C150, packaging in a 50 kg/bag

Water: Fresh and clean water from Nam Ngiep River

Admixture: Rheobuild 1008 (BASF) or equivalent

The proposed grout mix result has the following properties:

Bleeding (@ 2 hours)

Viscosity

Density

The method for testing, as shown in Appendix 8.

The proposed grout mix shall be mixed in the following proportion with respect to 50 kg cement.

Mix No.	W/C Ratio	Admixture (%)	Cement (Kg)	Water (liter)	Admixture (Liter)	Total Volume (Liter)
Mix-01	0.65:1	0.50	50	32.5	0.215	48.59
Mix-02	0.65:1	0.75	50	32.5	0.323	48.70
Mix-03	0.65:1	1.00	50	32.5	0.431	48.80
Mix-04	0.75:1	0.50	50	37.5	0.215	53.59
Mix-05	0.75:1	0.75	50	37.5	0.323	53.70
Mix-06	0.75:1	1.00	50	37.5	0.431	53.80

6. Equipment and Tools

6.1 Drilling Equipment

The coring machine will be used to drill holes, with a diameter of holes of 65 mm.

6.2 Grout Mixers

The Grout mixer will be GM-300 a high turbulence mixer, powered by an electric motor. The Grout mixer will be operated at high speed at 1,600 rpm and will be installed in the mixing plant as close to the working area.

6.3 Grout Agitator

The agitator will be mechanical impeller type, GA-300, or GA-500, powered by an electric motor where the grout is thoroughly mixed slowly by a revolving paddle to keep the grout particles in suspension while awaiting the injection.

6.4 Grout Pump

The grout pumps will be duplex triple-acting piston type, SGB-610. The pumps will be capable of operation at a maximum pressure of 10 MPa and flow rate 0-100 liters/min.

6.5 Grout Recorder

The automatic grout recorder will be used to measure and record grout flow rate, grout volume, and injection pressure. The cement grouting and chemical grouting will be recorded by CMS2008, with the range of measuring flow rate 0- 150 l/min and pressure 100 bars.

6.6 Water pump

The water pump for the water pressure test will be a triple plunger type, which will have a capacity of operating maximum pressure of 10-50 bars and a flow rate of 90-120 liters/min.

6.7 Electric Generator

The electric power supply from the electric generator is approximately 125 KVA,380V by power supply line for drilling equipment and grouting equipment.

6.8 Packer

The packers are used to seal off or isolate a portion of the sleeve port along the grout hole that allows the grout to be injected under pressure into the rock foundation. The pneumatic inflatable single packers or normal packers are proper for grouting. The mechanic packer will be used as a plug to stop the leakage point.

6.9 Water flow meter

All water meters will be calibrated before use with the master water flow meter, the meter will be used for measuring the amount of water for the grout mix and the amount of water lost for the tracing test.

6.10 Pressure gauge

All the pressure gauges will be calibrated before use with the master pressure gauge. The pressure gauge will be used to monitor the injection pressure of the injection and will be used for tracing tests.

The list of main equipment and tools is shown in the table below, and the equipment characteristics, as shown in Appendix 3.

No.	Description	Model	Capacity	Quantity
1.	Coring Machine	KOKEN SD-3A	Depth 0-50 m.	1
2.	Grout Mixer	GM-300	300 liters	1
3.	Grout Agitator	GA-300	300 liters	1
4.	Grout Pump	SGB-610	100 l/min, 10 Mpa	1
5.	Grout Recorder	CMS2008	150 l/min, 10 Mpa	1
6.	Water Pump	HL-120	10-50 bar, 90-120 l/min	1
7.	Electric generator	CUMMINS	125 KVA, 380 V	1
8.	Mud balance	OFFI		1
9.	Marsh funnel	OFFI		1
10.	Measuring cup	OFFI		1
11.	Graduated cylinder 50-1000 ml	Standard		3
12.	Pick up			2
13.	Truck crane			1
14.	Drilling accessories and tools such as a diamond core bit, drilling rod, water hose, wrench, etc.			
15.	Other accessories as high-pressure washer, single packer, mechanic packer, water meter, hose, hand breaker, cutting device, electric cutter, cover sheet, and etc.			

7. Utility Supply

7.1 Electric Power Supply

Electric power from the electric generator or the main electric power line will be used for performing the work. The electric cable will be connected from the generator or the power supply line through the working area. The total requirement will be approximately 125 KVA. The main electric control boxes will be installed in the working area.

7.2 Water Supply

Water will be pumped from the Nam Ngiep River or a nearby source that will be 20-50 liters/min into the 3.0*3.0*1.0 m settlement tank. The supply hose is connected from the settlement tank to the main grout plants and working areas. Estimated water usage per day will be around 10 cu.m.

7.3 Grout Supply

The main grout plant will be set on the dam crest at the right abutment, close to the working area. The cement milk will be mixed at the main plant and pumped through the flexible high-pressure hose directly to the grout hole.

7.4 Drainage and Solid Waste Disposal

The drilling wastewater is intermittently blocked by sandbags to prevent sediment from spreading over a wide area.

The wastewater from mixing will be pumped to the wastewater pond. The pH will be controlled by using hydrochloric acid or a similar suitable material. The treatment system will be installed on-site close to the mixing plant.

Dirty water from drilling will be filtered before to the Nam Ngiep River and the solid waste from the sedimentation and drilling process shall be regularly collected by hand, stored in a plastic bag or sandbag, and disposed of at a suitable location acceptable to the Owner. The details are provided in Appendix 6.

7.5 Communication System

Communication during all work will be communicated by walkie-talkie radio communication system or mobile phone.

8. Construction Procedure

8.1 Preparation

- Transport the drilling equipment, generator, grout mixer, grout agitator, grout pump, all accessories, and all necessaries to the site**.**

- Setting all main equipment to the working area.
- Prepare the disposal system for wastewater from mixing and drilling cutting**.**
- Install electric system.
- Install necessary safety equipment.

8.2 Cleaning Work

Before drilling, the high-pressure water pump shall be used to clean the rock surface where is working area is approximately 3 m. upstream side from dam body. The cleaning shall be clean and clear to observe cracks on the rock surface.

8.3 Drilling work

All information such as the location of the hole will be instructed by the Owner. The diameter of 3”-4” shall be drilled by coring equipment for 2 m and the angle of hole is 30° from the rock surface towards the mountainside. The spacing is indicated in the drawing or as instructed by the Owner. The angle will be measured by the magnetic angle tool and the azimuth will be measured by a compass to calculate the direction of the hole.

8.4 Tracer Test

A tracing test shall be performed to obtain the direction and to evaluate the appropriate time of water leakage. The testing method will be defined as follows:

- Mixing the colored water using Potassium Permanganate (KMnO4) or food coloring in the storage tanks.
- Inject the colored water by the high-pressure water pump by 1 bar or as instructed by Owner through the hose and packer into the grout holes.
- When the colored water is observed, the exposed time will be recorded including the location of the water leak and direction of leakage.

8.5 Grouting

Grouting operation is generally carried out without interruption. In case the grouting takes much volumes, the interruption is necessary. The interruption number shall be discussed and revised depending on the suitability of geological conditions and comparison with the machineability. In case of occurrence of interruption due to breakdown of water or power supply or mechanical failure, the grout operation will be recovered as far as it is practicable. In the case of grout communication to the drainage hole at J27 with a small amount of grout absorption, the grout operation will be continued. In case a large number of grout leaks, the communicated drainage holes will be packed with a packer while the holes are being grouted, and maintain the grouting pressure to 1 bar or as instructed by Owner.

In case of leaking to the rock surface, the grout will be stopped and sealing of the surface will be performed by using cement milk and an accelerator. The injection pressure shall be used depending on the tracing test result or as instructed by Owner.

8.6 Filling up

After completion of grouting, the grout hole shall be backfilled by the suitable cement milk.

8.7 Concrete cap

After completion of Filling up, the grout hole shall be capped by concrete slab with wire mesh, a width of 2.5 m, a length of 3.0 m, and a thickness of at least 20 cm. The cleaned rock surface area that is close to the grout hole shall be capped by concrete with a thickness of 10 cm and including steep slope area shall be capped by concrete as well.

8.8 Rehabilitation work

The rehabilitation work will be performed after all of the work has been completed. The high-pressure water pumps and cleaning equipment will be used for cleaning at the grouting plant, floor, and around the working area.

8.9 Data Record

The drilling and grouting data will be recorded on the standard datasheet and the data will be continuously analyzed to optimize the grouting process in the field. The records will be included in the following data:

- Hole no.
- Location
- Station, inclination, azimuth, the elevation of the hole
- Date and time
- Depth of hole, stage number, length of stage, packer depth
- Grouting pressure
- Grout mix ratio
- Quantity of injection cement
- Quantity of cement usage
- Etc.

The drilling and grouting report form is presented in Appendix 7.

9. Safety Control

9.1 Responsibility

The site manager will assign a safety officer to ensure safety compliance with all applicable requirements and to prevent any incidents and damage to property.

9.2 Hazard Identification

Hazard identification shall be emphasized in the following major activities transport, handling, and use of hazardous materials.

9.3 Risk Control Measures

- Toolbox meetings shall be conducted by the Safety Officer to remind the individual of work and safety issues related to the work.
- The safety officer shall check and ensure that appropriate "Personal Protective Equipment" (PPE) and provided to the workers and training.
- The monitoring all devices and materials will be protected by a plastic sheet and plastic curtain.

10. Quality Assurance

The Site Engineer will be assigned to inspect the works execution and the compliance with the design drawing, technical specifications, and method statements, and to prevent the occurrence of errors and discrepancies.

Grouting profiles with the cement takes are updated a day to a day and the results will be regularly discussed with the Owner. During the course of grouting work, laboratory testing of grout mix will be performed as indicated in the table below.

Test Item	Criterial	Frequency	Implementation Period
Inspection of discharge and pressure value of flow meter	Specified value by manufacturer	1 time/2 month. Every time the plant location is changed	Before commencement of work
Unit weight test of grout	A tolerance of ±5%	1 time/AM and PM	Construction date

Flow test	30 – 35 second (W/C=0.75:1) 35 – 40 second (W/C=0.65:1)	1 time/AM and PM	Construction date
Bleeding	Less than 5%	1 time/AM and PM	Construction date
Temperature of grout	Less than 35 ℃	1 time/AM and PM	Construction date
Temperature of water for mixing	Less than 35 ℃	1 time/AM and PM	Construction date

B. Site Specific Environment & Social Management & Monitoring Plan (SS-ESMMP) for Investigation of Leakage Path at J27

11. Introduction

This Site Specification Plan has been prepared to highlight environmental and social conditions prior to the beginning of each construction activity and will be used as a tool to ensure the particular activity follows the correct management and mitigation procedure. Sub-plans will be used to detail mitigation methods for each of the activities associated with the construction activities.

The owner's (NNP1) documents use references and information from the Concession Agreement.

This SS-ESMMP (Contract) uses references and information from the Owner's EIA/ESMMP and the Owner's ESMMP-OP

Table 1. The List of Main Documents and Approving Authority

No.	Hierarchy of Documents	Approving Authority
1	Concession Agreement	GOL
2	NNP1 EIA/EMMP	GOL
3	ESMMP-OP	GOL
4	SS ESMMP	NNP1

The Contractor documents are; SS ESMMP (Item4) which have used applicable information extracted from the Owner documents which are Concession Agreement (Item 1), NNP1 EIA/EMMP (Item 2), and ESMMP-OP (Item 3). All obligations of the contractor are stated in the Contract and are the only governing document for the Contractor.

12.Environmental and Social Pre-Construction Description

12.1 Land use in the area

There is land use at the right abutment of the main dam.

12.2 Proximity to the village, cultural sites

The closest village to the construction area is Ban Hat Nguin which is around 4 km away from the construction site. There will be no impact on cultural sites.

The table below is a pre-construction checklist to identify any major environmental impacts that may occur during construction works. After completion of the checklist, the Sub-Plans can be selected accordingly.

Table 2. Environmental Assessment Checklist – For Pre-Construction

Construction Site Assessment Checklist – for Pre-Construction Form			
Site Location:	Investigation of Leakage Path at J27		
GPS Coordination:			
Photo:			
Date:	1st June 2025		
Estimated Area	Area for Investigation of Leakage Path at J27 20 m^2		
Prepared By:			
Checked By:			
Site Description:	Right Abutment of Main Dam		
Item	**Yes**	**No**	**Description**
Will the site require UXO clearance?		X	UXO clearance has been completed for Main Dam
Is there surface water located in close proximity to the site?	X		This work is carried out in the gallery of the main dam under Nam Ngiep River
Is there a village or community located in close proximity to the site?		X	Bat Hat Nguin, which is around 4-5 km away from construction site

Is the site located in a vegetated area?		X	This work is carried out in the gallery of the main dam
Is the site located in agricultural land?		X	No agriculture land
Are there any PCR sites in the area?		X	No confirmed PCR on site
Is there an existing access road to the site?	X		Road to the Powerhouse and the left bank of Nam Ngiep River
Can the site be viewed from public viewpoints?		X	The site is closed off to the public
Is the site located within an existing Construction Area?	X		This work is located upstream side of main dam close to the river
Will the site development require the construction of a sub-camp, office, and storage? (if yes, provide a list)		X	No camp, office, or storage on the site
Other Comments?: None			

Environmental Impacts	**Likelihood (Yes/No)**	**Mitigation measure to be implemented**
Will the site development result in increased dust generation at nearby villages?	No	No village close to the site
Will the site development result in increased noise generation in nearby villages?	No	No village close to the site
Will the site development result in surface water contamination?	Yes	Wastewater pond and sedimentation pond will be installed
Will site development result in changes to drainage patterns?	No	The construction work does not disturb natural streams or drainages

Will construction activities result in erosion?	Yes	This work is located upstream side of main dam close to the river.
Will vegetation clearing be required?	Yes	Clearing work has been carried out for the drilling
Will the site be setting up hazardous components? (Storage and workshop)	No	The hazardous material shall be stored in the designated hazardous material storage area at the Contractor's camp (Location has been provided)
Will the site generate waste?	Yes	Rubbish and garbage will be gathered and transported to the approved disposal area. All hazardous materials will be
		

Identifies the relevant list of Sub-Plan required for additional drainage work were selected after a review of the following.

- Detailed Works Program (DWP)
- Pre-construction assessment (as per attached Environment Checklist)
- NNP1 EIA and ESMMPs

Table 3. Relevant Sub Plans for Additional Drainage Work

Sub-Plan	Item	Environment	Social
SP02	Hazardous Material Management	X	-
SP03	Project Waste Management	X	-
SP04	Waste Water and Surface Water Run-off Management	X	-
SP09	Decommissioning and Rehabilitation	X	-

Detailed descriptions are found in the relevant sections relating to Environmental or Social Management and Monitoring Plans.

13. Sub-Plan Detail for Additional Drainage Work – Environmental

SP02 Hazardous Material Management

- All workers always must wear PPE on-site.
- Any hazardous shall be stored properly in designated hazardous material storage.
- Hazardous material inventory including Material Safety Data Sheet (MSDS) shall be registered and provide on-site.
- The fuel and oil or similar shall be contained in proper storage.
- The storage should have adequate roofing and concrete floor to reduce the risk of any spillage.
- Provide the fire extinguisher on site.

SP03 Project Waste Management

- General waste or recycled waste must be collected and transported to the correct disposal.
- The bin or garbage will be supplied on-site.

SP04 Waste Water and Surface Water Run-off Management

- The sedimentation pond and Wastewater treatment plan is provided in Appendix 6 and shall be modified where necessary

SP09 Decommissioning and Rehabilitation

- Rehabilitation plan is provided in the DWP and shall be further discussed where necessary. Other information related to the environment is found elsewhere in the documents submitted.

14.Chance find procedures

Objectives of Chance Find Procedures are to; (a) minimize impacts to resources from all NNP1 related activities and (b) ensure that any artifacts uncovered are appropriately recorded, documented, and reported to the appropriate line agencies.

If any fossil or cultural item of significance is found the Contractor will promptly give notice to the owner. This follows the guidelines stated in the Civil Works Contract "CWC" Clause 4.25 regarding Fossil and Artifacts.

Chance Find Procedures mentioned in the Contractors SSESMMP, Sub-Plan for Civil Works contract, "Cultural Resources" also states the following steps will be implemented if previously unidentified artifacts are identified:

(i) The contractor shall immediately cease operations in the area where artifacts/archaeological finds are unearthed and immediately inform NNP1 Site Manager;

(ii) The Owner will consult the Head of the Village and Culture and Tourism Administration Office to obtain advice regarding the next steps.

(iii) The contractor to recommence work only after the Culture and Tourism Officer has provided official notification according.

Appendices

Appendix 1. Construction Schedule

Appendix 2. Organization Chart

Appendix 3. Characteristic Equipment and Tools

Appendix 4. Emergency Plan

Appendix 5. Measure for Safety and Risk Register

Appendix 6. General Arrangement of Temporary Facilities

Appendix 7. Inspection and Test Plan

Appendix 8. Method for Testing Grout Mix Properties

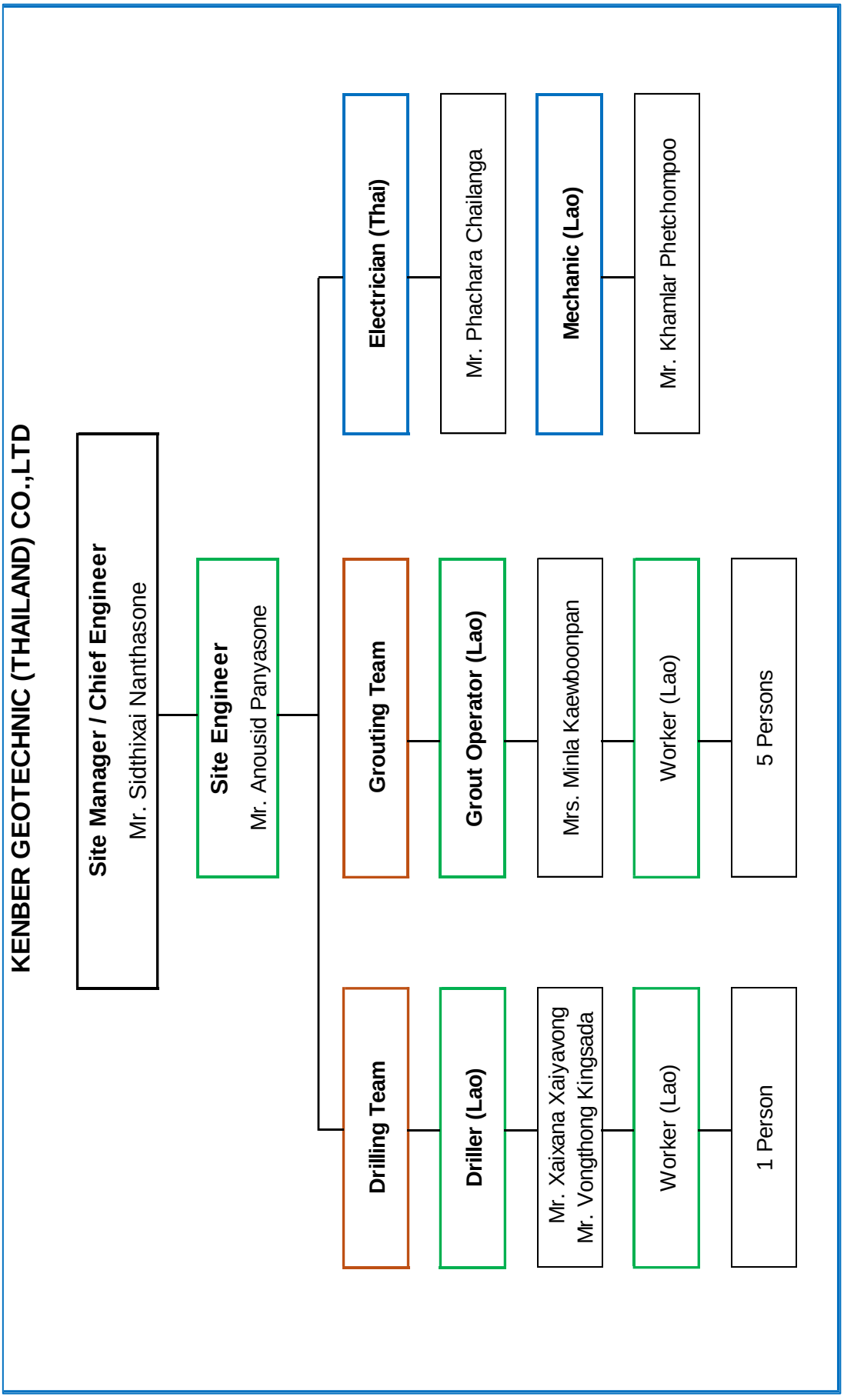
Appendix 1. Construction Schedule

Nam Ngiep 1 Hydroelectric Power Project

Schedule for Investigation of Leakage Path at J27

No.	Description	Jun-25																													Jul-27														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Mobilization																																													
2	Preparation for Accommodation, Office, and Facilities																																													
3	Transportation Equipment to Site and Site Preparation																																													
4	Calibration Grouting Equipment																																													
5	Trial Mix Test																																													
6	Drilling, Tracing Test, and Grouting																																													
7	Rehabilitation Working Area																																													
8	Demobilization																																													

Appendix 2. Organization Chart


KENBER GEOTECHNIC (THAILAND) CO.,LTD
Site Manager / Chief Engineer
Mr. Sidthixai Nanthasone
Site Engineer
Mr. Anousid Panyasone
Grouting Team
Grout Operator (Lao)
Mrs. Minla Kaewboonpan
Worker (Lao)
5 Persons
Drilling Team
Driller (Lao)
Mr. Xaixana Xaiyavong
Mr. Vongthong Kingsada
Worker (Lao)
1 Person
Electrician (Thai)
Mr. Phachara Chailanga
Mechanic (Lao)
Mr. Khamlar Phetchompoo

Appendix 3. Characteristic Equipment and Tools



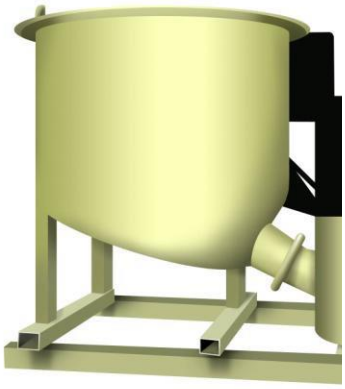


Manufacturer			KOKEN BORING MACHINE
Model			SD-3A
Drilling depth		m	50
Spindle	Inside diameter	mm	43
	Rotation	rpm	42 , 72 , 105 , 164
	Stroke	mm	300
water pump	Discharge capacity	Gal (UK)/min (l/min)	9 (7) 40 (30)
	Working pressure	N/c㎡	1.5 (1.0)
Dimensions (L x W x H)		mm	1,260 x 770 (700) x 980
Weight (excluding power unit)		kg	260 (250)
Power unit		kW-P	Motor 2.2-4
		PS	Engine 5

KENGROUT – GM Grout Mixer & Agitator

Grout Mixer is specially used in grouting construction to mix slurry .There is wide application in engineering department of water resource and electric power, coal, railway, traffic, construction, mine and etc.

To mix water, cement, bentonite, sand and other additives rapidly .Available both 150 and 300 Model



Technical Specification

Model	Unit	GM-300
Volume	Liter	300
Inlet Connection	mm	50
Outlet Connection	mm	50
Dimension)LxWxH(	mm	1500x1000x1250
Power	KW	7.5
Power Supply		10HP 380V 50Hz
Spindle Speed	rpm	1600



Grout Agitator is used as holding tanks between the mixers and grouting pump.

The slowly revolving agitator homogenizes the grout suspensions, ensuring that air bubbles are removed.

Technical Specification

Model	Unit	GA-300
Volume	Liter	300
Inlet Connection	mm	38
Outlet Connection	mm	38
Dimension)LxWxH(	mm	1000x1000x1260
Power	KW	0.75
Power Supply		1HP 380V 50Hz
Spindle Speed	rpm	100

Catalog and Specification of SGB 6-10 Grouting pump



SGB6-10 grouting pump, as a special device for cement grouting or mortar grouting construction, is mainly used for hydropower engineering batholite curtain grouting, side slope consolidation grouting, tunnel grouting, coalmine grouting waterproofing work and other strengthening works, has strong adaptability to large-flow and high-pressure grouting, can serve as slurry pump to supply washing fluid to drill hole during core drilling operation, and obtained national coalmine *Safety Mark* certificate.

Main Features

1. The pump is three-cylinder single-action plunger quantitative grouting pump.
2. This pump technology parameters and structure very suitable to the large concentration, high pressure grouting.
3. This pump into row of slurry valve using ball valve, can be used for filling slurry.
4. This pump strength is good, the use of safe, reliable performance.
5. The wearing parts have easy replacement and maintenance.

Technical Parameters

Model Specifications	Unit	SGB 6-10
Type		Three-cylinder Single-action Plunger Variable Pump
Displacement	L/min	100
Maximum Pressure	MPa	10
Piston Diameter	mm	60
Piston Stroke	mm	85
Reciprocating Times of Piston	min^{-1}	152
Port diameter	mm	50
Suction pipe diameter	mm	50
Motor		Y180M-4 18.5kW YB180M-4(KB) 380/660V 18.5kW 1470r/min
Weight (Excluding Power Machine)	kg	750
Overall Dimensions (L*W*H)	mm	1890*860*620

POWER SPRAYER

COMPACT STRUCTURE, HIGH PRESSURE AND LARGE FLOW

The company continuously strengthen technical innovation, and promote the transformation of new technological achievements into productive forces.



■ PRODUCT INFORMATION



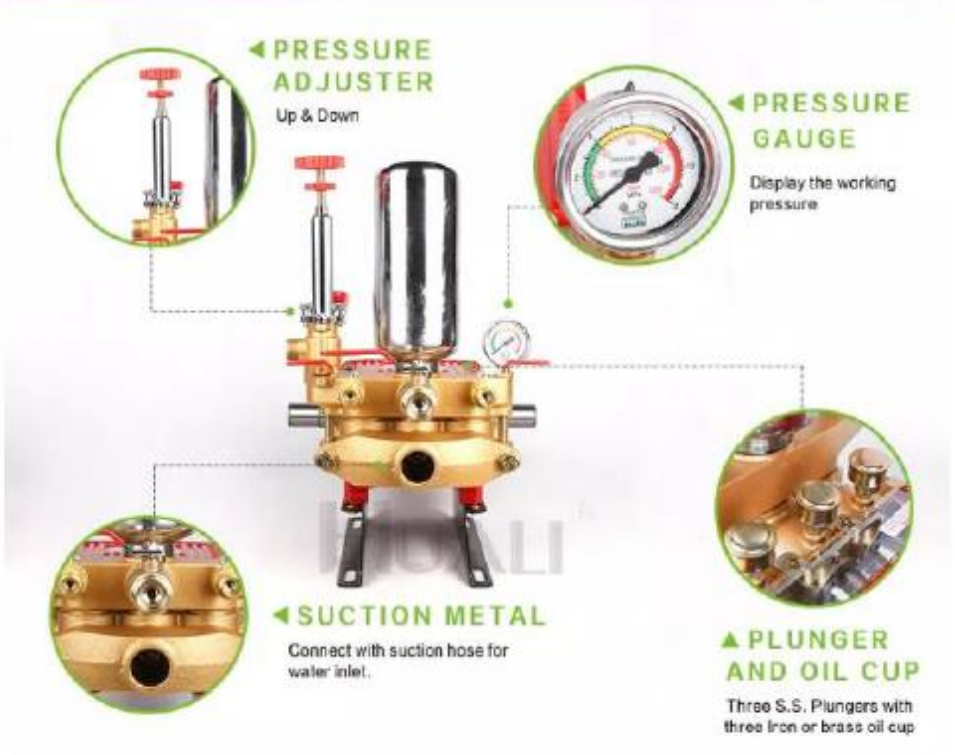






Model		HL-120A
Plunger No		3
Plunger dia (mm)		38
Stroke (mm)		38
Rotation Capacity (r.p.m)		700-900
Suction volume (L/min)		90-120
Pressure (Bar)		10-50
Require power	kw	7-9.5
	ps	10-12
Weight (kg)		31
L× W×H Dimension (mm)		550×380×550

■ PRODUCT DETAILS SHOW



Feature:

1. Heavy duty structure make pump high performance.
2. Application for ariculture like pest control, Irrigation, farm cleaning, cooling air for chickenfarm, misting for green house, fish net cleaning, wall, floor cleaning Etc.

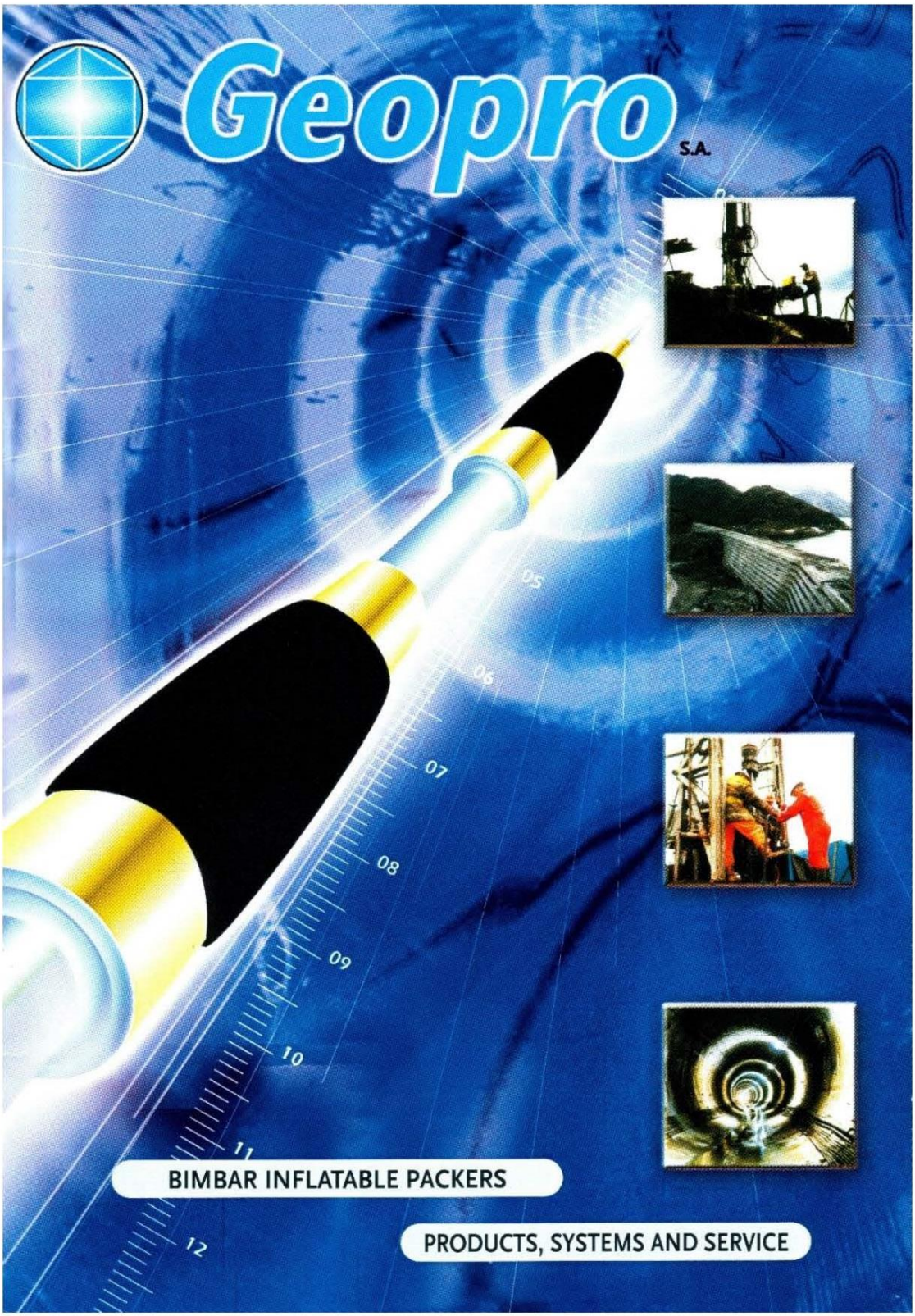
■ RELATED ACCESSORIES



ELECTRIC GENERATOR



BRAND	CUMMINS	Generator Set Model	CGE-100GF
Engine Model	6BTA5.9-G2		
Engine Specifications	Consumption	Oil(g/KW.h)	≤1.3
		Fuel(L/H)	≤26
	Continuous Output(KW)	110KW/138KVA	
	Standby Output(KW)	120KW/150KVA	
	Cylinder Numbers	6	
	Bore(mm)	102	
	Stroke(mm)	120	
	Rated Speed (rpm)	1500	
	Displacement (L)	5.9	
	Compression Ration	17.5:1	
	Start Method	Electrical (Key)	
	Governing Method	Electrical	
	Air intake method	Turbo charged	
	Cooling Method	Closed Water Cool	
Alternator Model	Marathon		
Alternator Specifications	Rated Output(KW/KVA)	100KW/125KVA	
	Rated Current(A)	180	
	Rated Frequency(HZ)	50	
	Rated Voltage(V)	400/230	
	Exciting Way	Brushless	
	Power Factor	0.8(Lag)	
	Connection Type	3Phase-4Wire	
	Protection	IP22	
	Class	H	
	Efficiency	91.4%	
	Bearing	Single bearing	
	OPEN TYPE OR SILENT TYPE		
Engine protection system: 1.Emergency. 2.Low battery warning. 3.Overspeed shutdown. 4.High water temperature shutdown. 5.Low oil pressure shutdown. 6. Over Crank. 7.All manual language is in English			


Geopro
S.A.
BIMBAR INFLATABLE PACKERS
PRODUCTS, SYSTEMS AND SERVICE

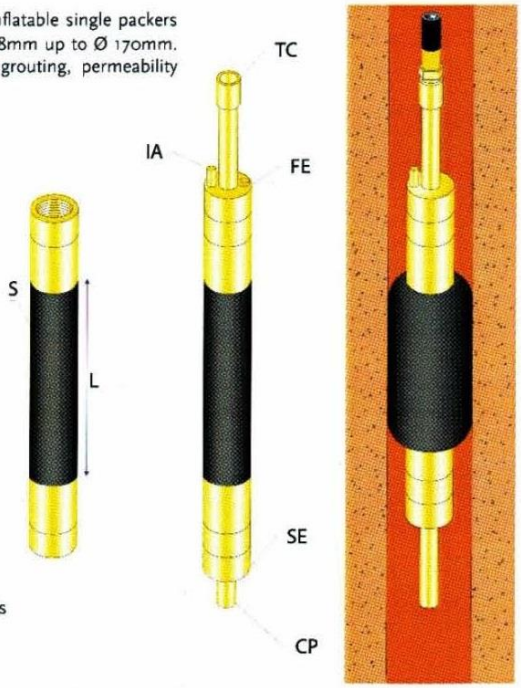
Inflatable single packers BIMBAR (28 – 170 mm)

Geopro manufactures a complete range of inflatable single packers available in nine different diameters from Ø 28mm up to Ø 170mm. These packers are mainly used for cement grouting, permeability testing...

The basic components of the packers are :

- **The upper fixed end (FE)** equipped with one or two inflation inlets with one adapter.
- **The center pipe (CP)**, made of stainless steel
- **The dilatable element (S)**, mounted with steel fittings on both sides
- **The sliding end (SE)**, equipped, up to Ø 102mm, with a scraper ring.

All Geopro packers are supplied with **inflation adapter IA (quick coupling type).** Cutting ring coupling are also available on request.



The length (L) of the dilatable element depends on the application requirements.
Standard lengths are :

- **L : 300mm** for Ø 28,30 and 42mm packers.
- **L : 500mm and 1000mm** for Ø 28,30, 42, 56, 72, 85 and 102mm packers.
- **L : 1000mm** for Ø130 and 170mm packers.

Other lengths are also available on request. These single packers can be easily transformed into ZI double packer

Main specifications and dimensions of single and double packers

Nominal diameter (mm)	Connection upper "TC"	Central tube "CP" Inner diameter (mm)	Expansion max. Diameter (mm)	Bore-hole max. diameter (mm)	Inflation Inlet(s)
28	3/8" BSP *	8	55	50	1X 1/8" BSP
30	3/8" BSP	8	55	50	1X 1/8" BSP
42	1/2" BSP	17	98	90	2X 1/8" BSP
56	3/4" BSP	20	125	110	2X 1/8" BSP
72	1" 1/4 BSP	35	160	150	2X 1/8" BSP
85	1" 1/4 BSP	35	185	170	2X 1/8" BSP
102	2" BSP	53	200	190	2X 1/8" BSP
130	3" BSP	83	270	240	2X 1/4" BSP
170	3" BSP	83	350	330	2X 1/4" BSP

* Optional 1/4" connection available on request

All dimensions and characteristics are indicative only and may be modified without prior notice.

Geopro



NUOVA FIMA

MGS10

bourdon tube pressure gauges
anti-vibration version
DS 2" (50mm)



CE EAC

PED 2014/68/EU

Instruments designed for use on power units, pumps, hydro-cleaning machines, presses, engine compressors, turbines, diesel engines, chemical, petrochemical and refrigerating plants and on machines and equipment where pulsating pressures or mechanical vibrations are apparent. They can be used with gaseous or liquid media which do not corrode copper alloy and which do not have high viscosity or do not cristalize.

1.10.2 - Fillable Model

Design: EN 837-1.
Ranges: *from 0...30 to 0...6000 psi* (from 0...2,5 to 0...400 bar)
Accuracy class: 1,6 as per EN 837-1.
Ambient temperature: *-13...+149°F* (-25...+65 °C).
Process fluid temperature: *+248 °F* (max +120 °C).
Thermal drift: max ±0,4 %/10 °C of ranges (starting from +68°F - 20°C).
Working overpressure:
75% of FSV for static pressure;
66% of FSV for pulsating pressure;
Overpressure (max 15 min):
25% of FSV of ranges ≤ *1450 psi* (100 bar);
15% of FSV for ranges over *1450 psi* (100 bar).
Protection degree: IP 65 as per IEC 529.
Socket material: copper alloy.
Bourdon tube: copper alloy.
Case: stainless steel.
Window: plastic.
Movement: copper alloy.
Dial: aluminium,white with black markings.
Pointer: not adjustable, aluminium,black

1.10.3 - Filled Model

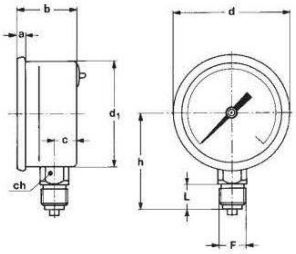
Damping liquid: glycerine 98%.
Ambient temperature: *+32...+149°F* (0...+65 °C).
Process fluid temperature: *+149°F* (max +65 °C).
Other features: as fillable model.

ISO 9001 : 2008
Cert. nr. 0433/6

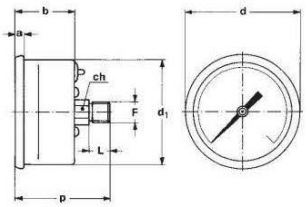
bourdon tube pressure gauges
anti-vibration version, DS 2" (50mm)

MGS10

RG6 - 03/14



A - LOWER CONNECTION



D - BACK CONNECTION

Mounting	F	a	b	c	d	d_1	h	p	L	ch	Weight (1)
Lower	21M - G 1/4 A 23M - 1/4-18 NPT	*0.15"* (4)	*1.14"* (29)	*0.43"* (11)	*2.20"* (56)	*2.00"* (51)	*1.87" - 1.94"* (47,5 - 49,5)		*0.51" - 0,59"* (13 - 15)	*0.55"* (14)	*0.22 lbs* (0,1 kg)
Back	11M - G 1/8 A 13M - 1/8-27 NPT	*0.15"* (4)	*1.14"* (29)		*2.20"* (56)	*2.00"* (51)		*1.81"* (46)	*0.39"* (10)	*0.47"* (12)	*0.18 lbs* (0,085 kg)

dimensions : *inches* (mm)

(1) add *0.09 lbs* (0,045 kg) when filled

OPTIONS

Model	fillable	filled
B - Clamp and ring for back connection pressure gauges	◆	◆

"HOW TO ORDER" SEQUENCE

Section / Model /Case / Mounting / Diameter / Range / Process connection / Options

1	10	2	A	B	11M	B
		3	D		13M	
					21M	
					23M	

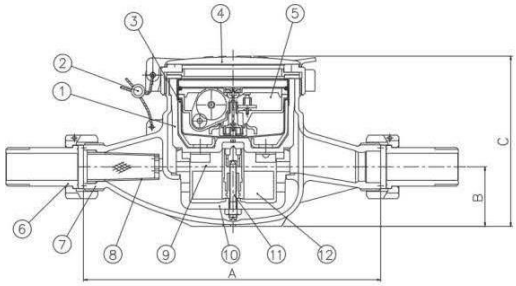
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มาตรวัดน้ำรุ่น จีเอ็มเค (Water Meter GMK)





Dimension

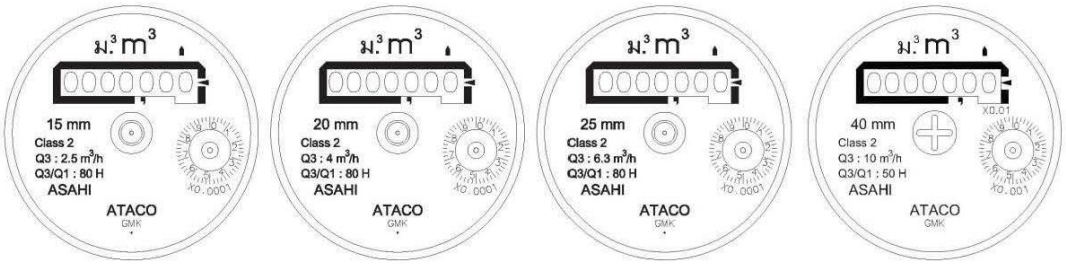
Model	Size	A	B	C	ISO R228 Thread on body	ISO 7-1 on coupling
GMK 15 R80	1/2"	165	33	94	G 3/4"	1/2"
GMK 20 R80	3/4"	190	35	105	G 1"	3/4"
GMK 25 R80	1"	225	35	105	G 1.1/4"	1"
GMK 40 R50	1.1/2"	245	45	116	G 2"	1.1/2"

Name of Part

NO	NAME OF PARTS	NO	NAME OF PARTS
1	UPPER CASING	7	BODY CASING
2	SEALING	8	STRAINER
3	MAGNET PROTECTION CUP	9	MEASURING CHAMBER
4	LID	10	LOWER CASING
5	REGISTER	11	PIVOT
6	COUPLING	12	VANE WHEEL

: Brass Body and Low - Pressure Die-Casting Process

: ตัวเรือนผลิตจากทองเหลืองขึ้นรูปด้วยกรรมวิธี Low pressure Die-Casting



ASAHI ผู้นำระบบมาตรวัดน้ำ Effective Date / June 01, 2021 ผลิตภัณฑ์ อาซาฮี

Water Meter GMK

The "GMK" Model Water Meters fall under the group of Inferential Meters and has Complete Dry-Dial, Direct Magnetic-Drive , Straight Line Reading and Multi Jet Principle. The water enters into the Meter through the inlet pipe and properly designed. Strainer, and affects its action upon the Vane Wheel. The particular advantage of this Meter is the Magnetic transmission directly from the Vane Wheel to the Register hermetically sealed, the Register is thus completely isolated from the water and is incorporated in a Dry Dial and is provided with Magnet Protection Ring.

Important Advantages

The hermetically Sealed Register Complete which contains Gears and Counter Wheel is completely isolated from water. Seizure of the Gears, staining of the Dial Plate, and condensation in the counter case are completely avoided. This means that there is greater advantages of operating safety, longer life, longer periods between servicing, and hence minimum operating costs.

Magnet Protection Ring is provided. Magnet Drive is protected by Magnet Protection Ring so that Magnet Drive cannot be badly influenced and stopped by another Magnet from outside of this Meter.

No moving parts in water, except Vane Wheel. The Vane Wheel is light in weight and rest on the pivot of stainless steel, and offers the magnetic operation. In repairing, the Vane Wheel is easily changed at the lowest cost.

Straight Line Reading allows the flow quantity to be read from one litre by Digit. This means that the flow quantity is precisely and easily read from the smallest volume units without mistake.

Sensitivity at the low flow. GMK Meters are designed to provide with best sensitivity at the flow rate and with precise accuracy that is preserved for long period, as the Stuffing Box and Gland Friction have been omitted.

Pilot Star is provided. Pilot Star in the center of the Dial Plate is directly coupled with Vane Wheel; it serves to make a quick check of the flow sensitivity, and helps to detect the leakage in the water supply tube.

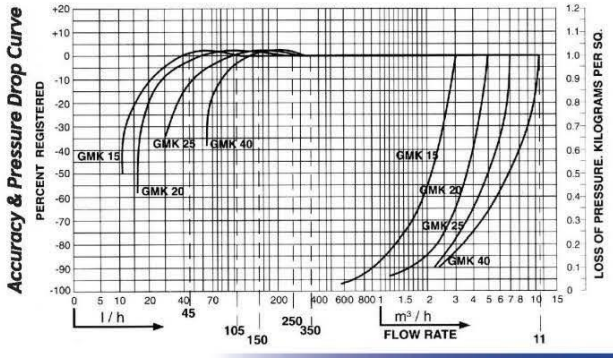
Easy to maintain at the lowest cost. The Register and Vane Wheel are an interchangeable unit at the lowest cost.

Determination of the Meter size The bore of the instrument depends upon the flow rate to be metered and not the pipe size. Too large flow rate, a meter will result in continuous overloading and high pressure drop. An over-sized meter on the other hand will be less sensitive to small flow rates and inaccuracy may result.

Technical Data

Model	GMK 15	GMK 20	GMK 25	GMK 40
Maximin Flow Rate 1Hr/day (Q4-m³/h)	3.125	5	7.875	12.5
Dynamic rangn (Q3/Q1)	80	80	80	50
Pressure drop at Q3 (bar)	0.63	0.63	0.63	0.63
Permanent Flow Rate (Q3-m³/h)	2.5	4	6.3	10
Trarsition Flow rate (Q2 - m³/h)	0.050	0.080	0.1008	0.32
Minimum Flow Accuracy (Q1 - m³/h)	0.03125	0.050	0.07875	0.2
Starting Flow Rate (l/h)	12	15	20	30
Smallest Digital Readable Amount (litre)	0.1	0.1	0.1	1
Max. Digital Registration(m³)	9,999	9,999	9,999	99,999
Overall length with coupling (mm.)	250	314	384	372

Maximum Water Temperature : 5°C – 60°C
Maximum Test Pressure 17.5 kgs/cm2
Material of Body Casting : Bronze JIS-BC6 (CU 85%, Sn 5%, Zn 5%, Pb 5%)



ASAHI ผู้นำระบบมาตรวัดน้ำ

Effective Date / June 01, 2021 ผลิตภัณฑ์ อาซาฮี

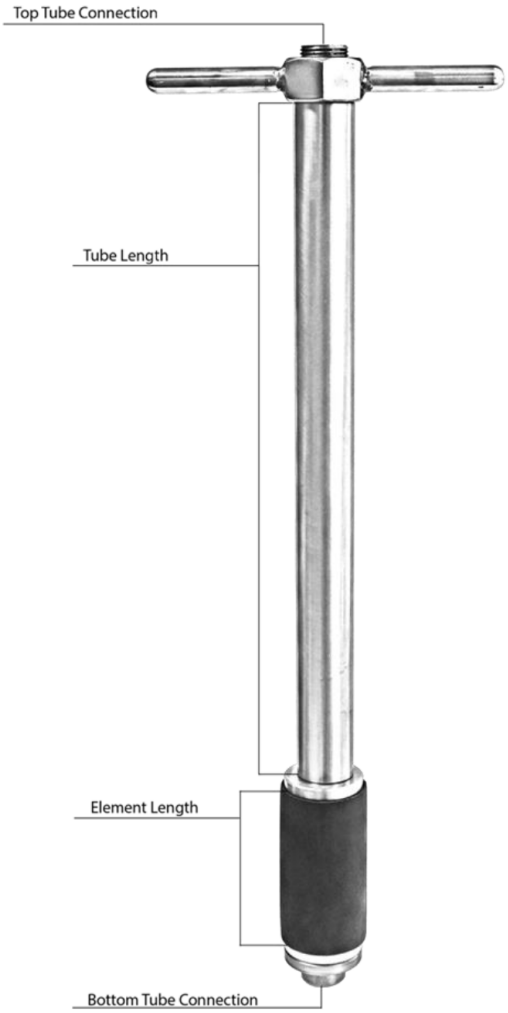
Mechanic Packer

Description

Designed to create a fixed seal on your well, the Mechanical Packer offers a simplified solution to your packer needs. The mechanical packer does not require continuous pressure from an external gas supply. This reduces cost as well as assures a continuous seal.
The Mechanical Packer compresses a rubber element inside the well creating an airtight seal, able to withstand up to 50PSI. The seal is compressed from the surface by tightening the T-handle.
Manufactured from 316 Stainless Steel, this packer can be combined with various feature options listed above in the drop-down menu.

Specifications:

For use in Pipe Size: 2" Sch40
Material: Stainless Steel
Element Material: EPDM Rubber
Element Relaxed OD: 1.94"
Element Length: 4"
Tube Length: Approx 30", 40" or 90"
Top Tube Connection: 1/2" M-NPT
Bottom Tube Connection: 1/2" F-NPT
Pass-thru Tube: .60" ID
Pressure Gauge: 0-100 PSI



Applications:

Mining - The Mechanical Packer can be used to test pressure levels in surrounding wells during Hydraulic Geological fracturing or Fracking

Artesian Wells - With many artesian wells, the constant flow of pressurized water is a blessing and a curse. By using a mechanical packer to seal off the well, you can regulate the pressure and stay below the frost line.

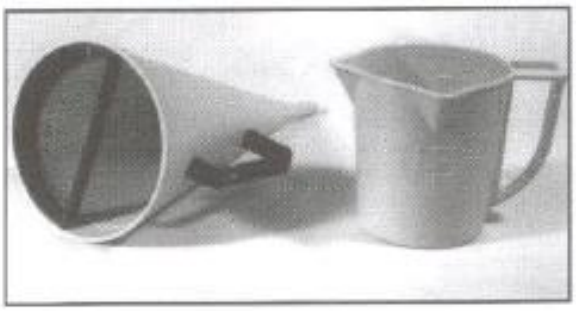
Sub-Frost Protection - By dropping the packer below the frost line, you reduce the likelihood of your well freezing during the cold winter months.

Sampling - By attaching the mechanical packer to a submersible pump, you can sample right through the pass-thru tube.

Injection - Similar to Hydraulic Fracturing, Injection treatments can put a strain on the surrounding soil formations. By positioning Mechanica packers with Pressure gauges around the injection site, you can assure your pressure doesn't reach dangerous levels.

MARSH FUNNEL VISCOMETER

Viscosity and gel strengths are measurements that relate to the flow properties of fluids. The Marsh Funnel viscometer has been used for many years to obtain an indication of the relative viscosity of drilling fluids. It is calibrated to outflow one quart (946 ml) of fresh water at a temperature of 70 ± 5°F (21 ± 3°C) in 26 ± 0.5 seconds. The OFI Marsh Funnel is molded from a tough, durable plastic that resists breaking or cracking. A brass orifice assures consistency in all readings.



No. 110-10 Marsh Funnel & No. 110-20 Measuring Cup

No. 110-10
MARSH FUNNEL VISCOMETER, OFI
Plastic, Beige

Size: 6.5 x 6.25 x 14.5 inch (16.5 x 16 x 37 cm)
Weight: 12 oz (34 grams)

No. 166-08
SHEAROMETER

The primary measuring device used in determining the gel strength of a drilling fluid is the Shearometer. The set includes two 5-gram, 3.5 x 1.4 inch hollow shear tubes and a sample cup with a graduated scale mounted in the center of the cup base. The scale measures gel strength in pounds per 100 square feet. A heavier (20 gram) shear tube with weight support is available for testing heavier muds and is specifically designed for testing high gel strength drilling fluids. It is common for 10 minute gels to reach 35 lb/100ft^2 and drilling conditions and economics will determine the need to reduce gel strengths.

Components:
#166-08 Shearometer, Complete
#166-12 Shearometer Tube, Aluminum, 5.0 gram

Optional:
#166-10 Shear Tube with Wt. Support, stainless steel, 20 gm
#166-02 Weight Set, 50 gm - 10 mg, with Box

MEASURING CUPS, OFI

To be used with the OFI Marsh Funnel Viscometer. The OFI Measuring Cup is graduated in fluid ounces (2 - 32 oz) and cubic centimeters (100 - 1000 cc). The heavy duty plastic measuring cup features a double spout and has the two scales molded into the inside of the cup for convenience. Also available from OFI are stainless steel measuring cups in 500 ml, 1000 ml and 2000 ml sizes.

No. 110-20
MEASURING CUP, 1000 ML, OFI Plastic, Beige

Size: 7.25 x 5.75 x 5.5 inch (18.4 x 14.6 x 14 cm)
Weight: 8 oz (227 grams)

Stainless Steel:
#110-30 Measuring cup, 500 ml, stainless steel
#110-40 Measuring cup, 1000 ml, stainless steel
#110-50 Measuring cup, 2000 ml, stainless steel

No. 155-25
STOPWATCH, OFI, DIGITAL

To properly perform the Marsh Funnel viscosity test, the OFI electronic digital electronic stopwatch may be used. The quartz crystal timer counts up to 30 minutes in 1/100 seconds and counts in seconds if over 30 minutes. Each stopwatch is calibrated against the National Institute of Standards and a test certificate is supplied with each timer. The calibration complies fully with the requirements of ISO 9000 Certification.

Size: 2.4 x 2.0 x 0.6 inches (6 x 5 x 1.5 cm)
Weight: 1.5 oz (43 grams)



No. 155-25 Digital Stopwatch

OFITE, 1006 West 34th Street, Houston,TX 77018-6321 USA / Ph: 713-880-9885 / Fax: 713-880-9886 / www.ofite.com

MUD BALANCES, OFI

One of the most important properties monitored throughout the drilling operation is the mud density. The OFI mud balance is engineered so that the mud cup at one end of the beam is balanced by a fixed counterweight at the other end, with a sliding-weight rider to move along a graduated scale. A level bubble is mounted on the beam to ensure accurate balancing. The OFI metal and plastic mud balances are rugged instruments built to withstand the hardships of oilfield testing, and are designed to eliminate the need for re-calibration.

The rugged standard metal balance has an enlarged, easily read scale, that is molded on top of the arm for clear accurate reading. This balance has the two most commonly used scales with the following ranges:

6.5 - 23 lb/gal
0.8 - 2.75 specific gravity

The arm is reinforced and will not easily break as some models are prone to do. Other features include a large 200cc sample cup for increased accuracy, an anodized aluminum beam for additional corrosion resistance and a stainless steel rider and heat treated knife edge.

The full sized plastic mud balance is imprinted with four density scales with the following ranges:

8.0 - 25 lb/gal,
1000 - 3000 sp.gr.kg/m^3
60 - 185 lb/cu.ft.
450 - 1300 psi/1000ft.

The plastic balance is more resistant to corrosive fluids, a major advantage in some applications.

Each balance may be readily transported in a light weight carrying case fitted for its usage and storage.



No. 100-60, 100-00 and 115-00-10 OFI Mud Balances

No. 115-00-10
MUD BALANCE, OFI, METAL
2-SCALE, with CASE

Size: 21.5 x 5.5 x 4.5 inches (54.6 x 14 x 11.4 cm)
Weight: 4 lbs (1.8 kg)

No. 115-00-11
MUD BALANCE, OFI, METAL
2-SCALE, without CASE

Size: 18.5 x 3 x 3.5 inch (47 x 7.6 x 9 cm)
Weight: 1 lb 12 oz

Components for Metal Mud Balances:

#100-25-1	Rider, for Metal Balance
#100-40	Case, Beige, for OFI Mud Balances
#100-56	Lead Shot, for calibrating Mud Balances
#115-06	Lid, stainless steel, for OFI metal balances
#115-14	Level Bubble Assembly, for metal balances
#115-16	Window, for Level Bubble Assembly
#115-22	Base, stainless steel, for metal balance
#115-32	Knife Edge, for metal balance
#115-34	Shotwell, for metal balance

No: 100-00
MUD BALANCE, OFI, PLASTIC
4-SCALE, with CASE

Size: 21.5 X 5 X 4.5 inches (54.6 X 12.7 X 11.4 cm)
Weight: 3 lbs (1.4 kg)

No. 100-01
MUD BALANCE, OFI, PLASTIC
4-SCALE, without CASE

Size: 18.5 x 3 x 3.5 inches (47 x 7.6 x 9 cm)
Weight: 9 oz (.25 kg)

Components for Plastic Mud Balances:

#100-10	Base, for plastic balance
#100-20	Lid, for plastic balance
#100-25	Rider, for plastic balance
#100-30	Level Bubble, for plastic balance
#100-40	Case, Beige, for OFI Mud Balances
#100-56	Lead Shot, for calibrating Mud Balances

No. 110-00
MUD DEARATOR with VACUUM PUMP

A hand operated vacuum pump removes gas from solutions to provide a more accurate fluid density measurement. Density readings are then provided using the conventional mud balance. Complete with mud chamber, paddle assembly and pump.

OFITE, 1006 West 34th Street, Houston,TX 77018-6321 USA / Ph: 713-880-9885 / Fax: 713-880-9886 / www.ofite.com



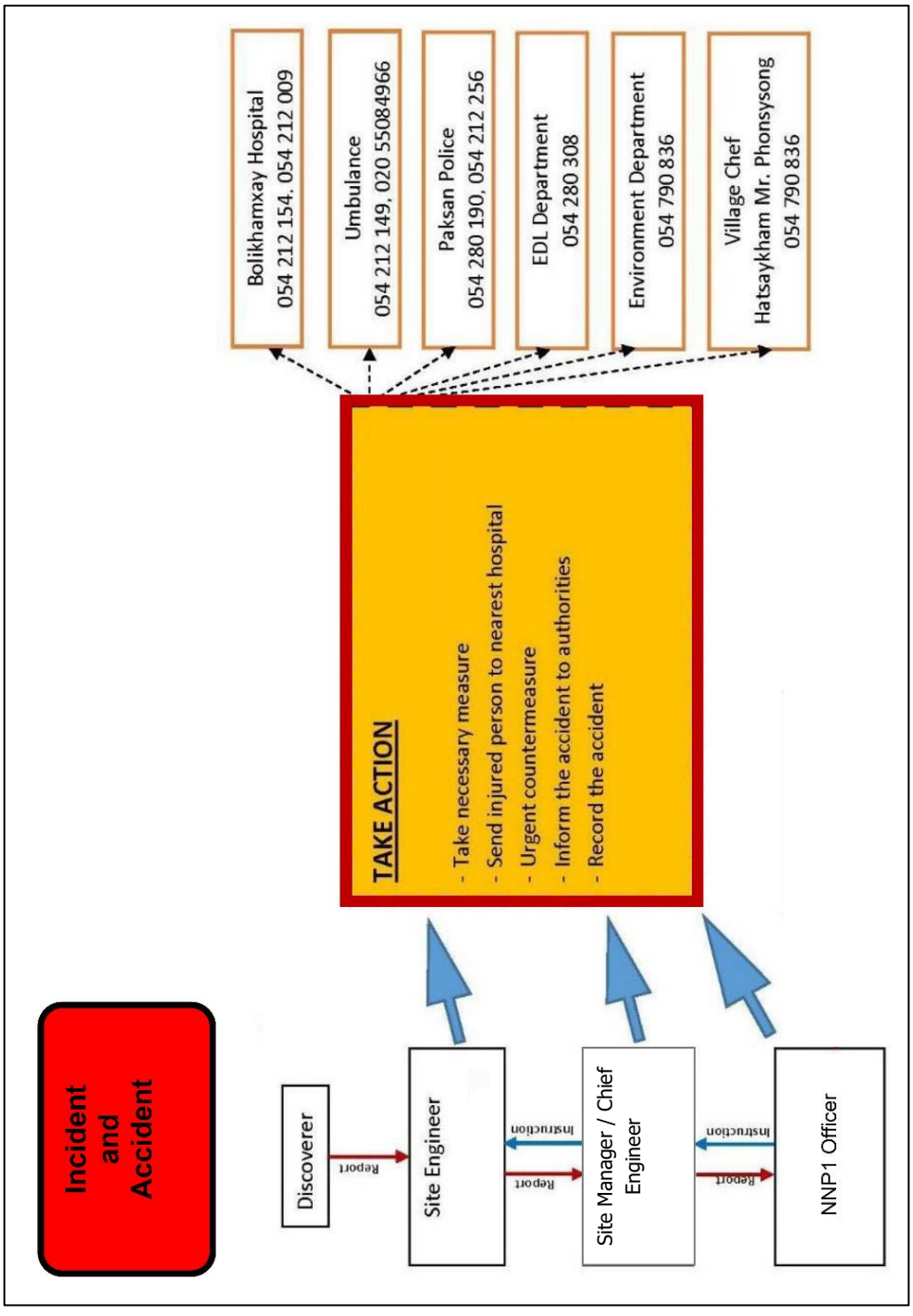
Measuring Cylinder, 1000ml - Class B Tolerance - Octagonal Base - Polypropylene Plastic - Industrial Quality

- INDUSTRIAL QUALITY || 1000ml capacity measuring cylinder. Class B tolerance. The translucent, rigid polymer construction is resistant to fatigue for superior and dependable durability
- OCTAGONAL BASE || Cylinder features a octagonal base for maximum stability
- RAISED GRADUATIONS || Superior optical clarity with easy to read, raised 10ml graduation lines that are marked every 100ml. Calibrated to contain
- POLYPROPYLENE CONSTRUCTION || Made of high quality polypropylene that features high heat tolerance, and good to excellent chemical resistance. Autoclavable for easy cleaning and sterilization
- GREAT FOR PROFESSIONAL LABORATORIES, CLASSROOMS & HOUSEHOLD || Designed for use in professional laboratories, but is an ideal choice for science classrooms and household use

Specifications for this item

Brand Name	EISCO
Capacity	1000.00 milliliters
Item Weight	6.4 ounces
Material	Polypropylene (PP)
Number of Items	1
Part Number	CH0354G
Specification Met	
UNSPSC Code	41000000

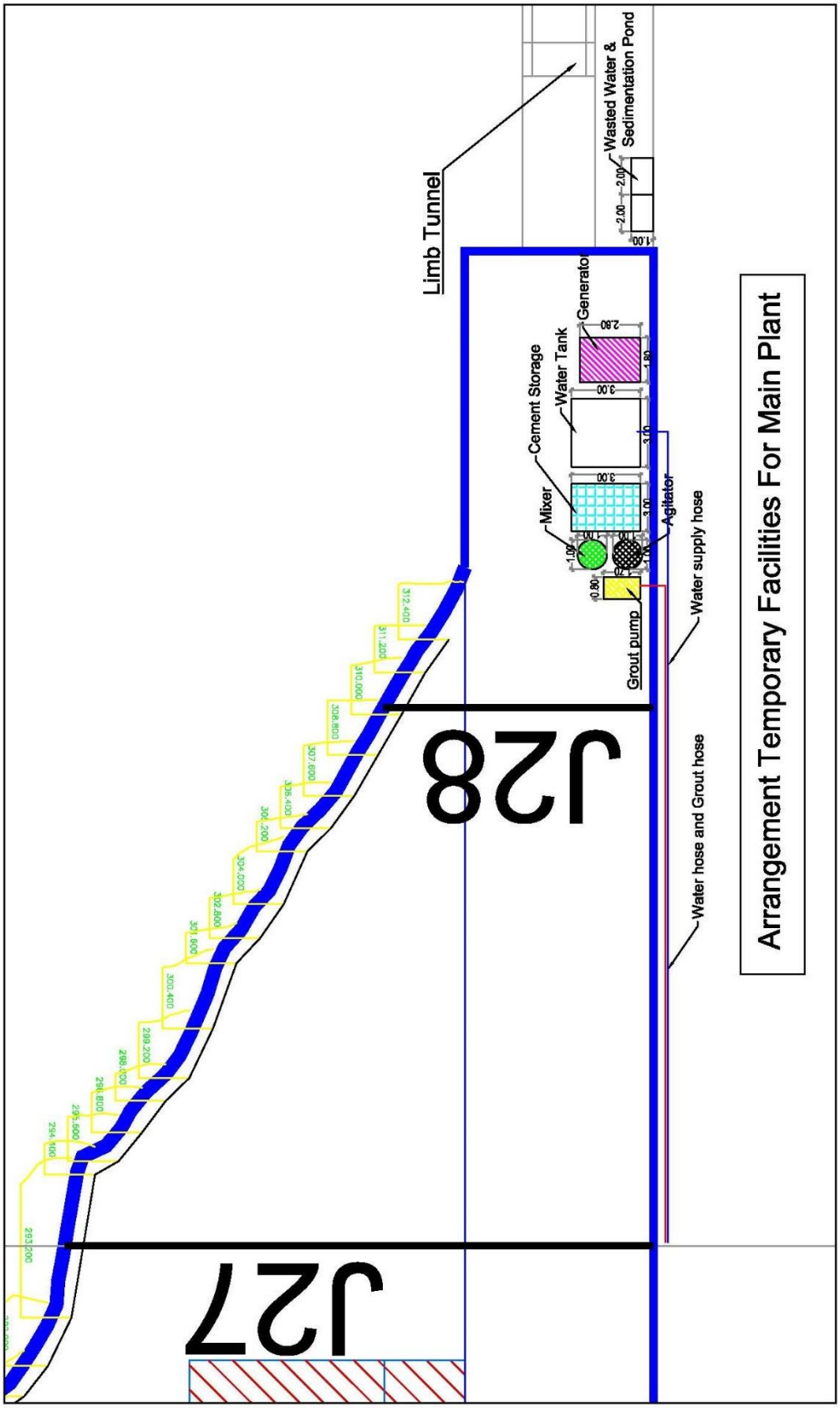
Appendix 4. Emergency Plan

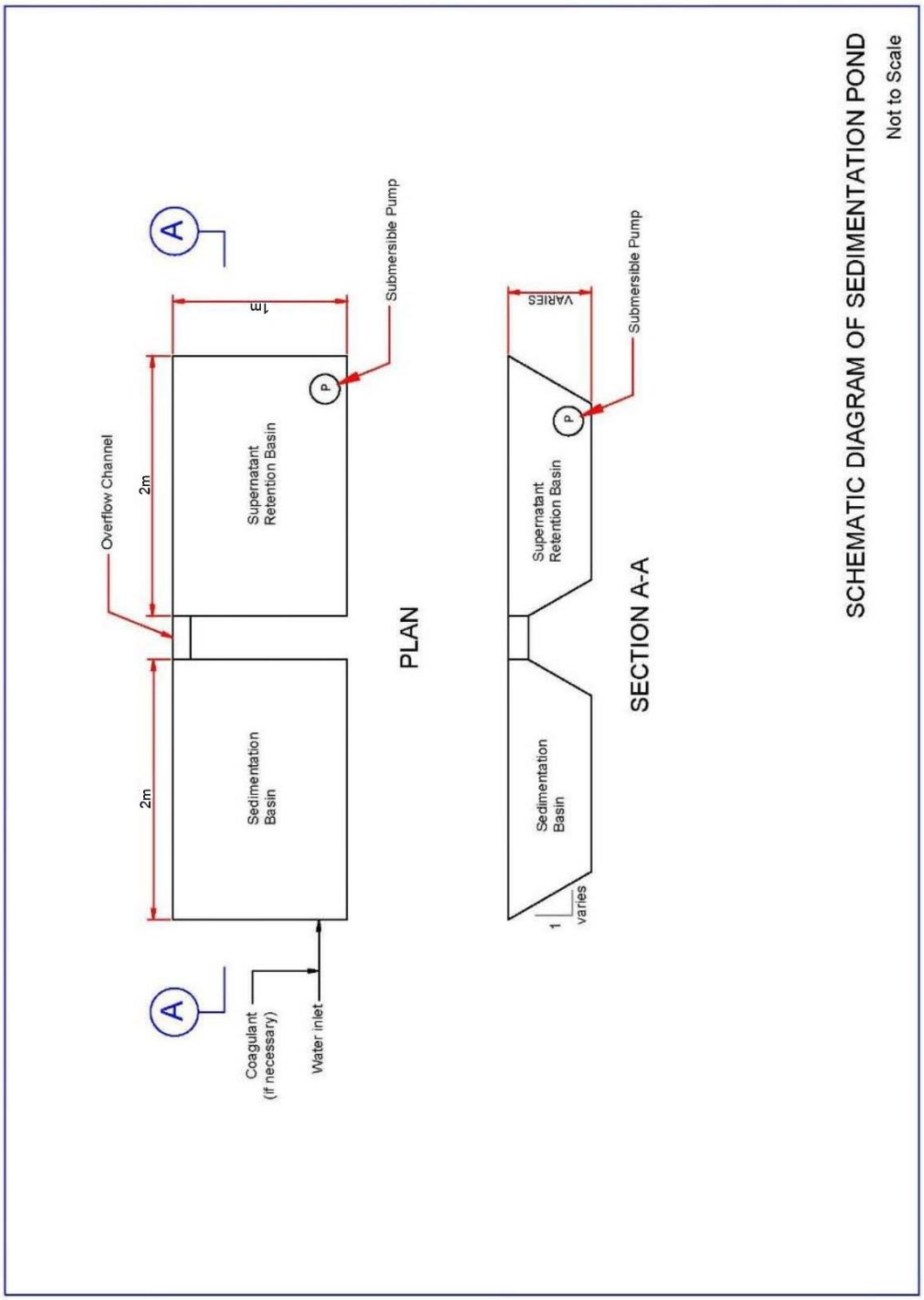

Incident and Accident
Discoverer
Report
Site Engineer
Instruction
Report
Site Manager / Chief Engineer
Instruction
Report
NNP1 Officer
TAKE ACTION
- Take necessary measure
- Send injured person to nearest hospital
- Urgent countermeasure
- Inform the accident to authorities
- Record the accident
Bolikhamxay Hospital 054 212 154. 054 212 009
Umbulance 054 212 149, 020 55084966
Paksan Police 054 280 190, 054 212 256
EDL Department 054 280 308
Environment Department 054 790 836
Village Chef Hatsaykham Mr. Phonsysong 054 790 836

Activity (Element)	Hazard	Cause	Comments/Constraints	Risk Control Measures
Drilling Works	• Use of high-pressure water and air jet	• Loss of water supply causing dust formation. • Hearing impairment due to continuous exposure from excessive noise	• Uncontrolled dust and noise pollution. • Unauthorized use of air pressure jet, entry of personnel at the cleaning area.	• Only trained and authorized persons are allowed to use equipment. • Toolbox talks. • The use of rod dope, grease or other lubricants on drill rods must not be permitted. • Provision of suitable and appropriate PPE's.
Grouting Works	• Use of hazardous materials/ substance • Use of grouting equipment	• Direct skin contact with hazardous materials/ substance • Grout mix burst due to over pressure pump.	• Insufficient provision of appropriate personal protective equipment. • Defective of relief valves, pressure gauges and pressure hoses. • No conduct of toolbox talks and lack of supervision.	• Provision of suitable and appropriate PPE's. Grouting pressure gauges must be heavy duty quality. • Grouting pressure must be maintained of the return-flow throttle valve. • Material Safety Data Sheet (MSDS) of all use hazardous materials /substances and other topics related to the activity must be delivered thru tool box talks by the in-charge Supervisor and Safety Officer
Use of Plants and Equipment	• Electrical, Mechanical and Fire Hazards	• Injuries, Fire	• Unauthorized person carrying out maintenance service of plants and equipment. Tag-out/lock-out not being practiced. • Unsafe grouting or layout of used electrical supply cable. • No provision of appropriate fire fighting equipment and suitable safety signs. • Missing earth system and exposed mechanical of suitable PPE's	• Competent persons assigned for electrical and mechanical plants. • Practice of tag-out and lock-out when servicing plants and equipment. • Proper layout of used electrical supply cables. Relevant toolbox talks and safety supervision. Suitable and appropriate PPE's.

Use of work Platform	• Erection, use and dismantling of work platform	• Personnel injury, damage to equipment. • Slips and Trips.	• Falling of personnel & loose equipment. • No safe access. • Unsafe scaffolding or working platform. • No tie off facility. • Persons not familiar with the specific task. • Not using safety harnesses. • Persons working under suspended platform or lifts. • No Supervision and toolbox talks.	• Safety harnesses to be worn and tied off a suitable /secure support. • Safe access and egress, ladders secured 1m above platform. • No loose equipment and debris on walk way to be kept clear. • Scaffold/Platform with handrail, midrail, toe boards and properly secured/stable. • Scaffold/Platform correctly assembled and disassembled. • Live lines anchored to suitable support or were required person tied off to structure. • Area below working platform to be safe, barricaded if required. • Communication between employees working at different levels to prevent a misunderstanding leading to accident. • Crew talk to all involved before work commence. • Dangerous work activities will require a full-time watcher to ensure compliance & enforce safety rules& regulations

Appendix 6. General Arrangement of Temporary Facilities


Arrangement Temporary Facilities For Main Plant
Limb Tunnel
Wasted Water & Sedimentation Pond
Generator
Water Tank
Cement Storage
Mixer
Agitator
Grout pump
Water supply hose
Water hose and Grout hose
J28
J27


SCHEMATIC DIAGRAM OF SEDIMENTATION POND
Not to Scale
PLAN
SECTION A-A
A
A
Submersible Pump
Submersible Pump
1m
VARIES
2m
2m
Overflow Channel
Supernatant Retention Basin
Supernatant Retention Basin
Sedimentation Basin
Sedimentation Basin
P
P
Coagulant (if necessary)
Water inlet
1
varies

Appendix 7. Inspection and Test Plan

NAM NGIEP 1 POWER COMPANY

Daily Request

☐ Cofferdam ☐ Spillway ☐ Quarry

☐ RCC Dam ☐ Powerhouse ☐ Curtain Grouting

Location :

Station :

Section :

Detail :

Req No.

Date

☐ Day shift

☐ Night shift

Start A.M. hrs.

Finished P.M. hrs.

Page to

No.	Description	Location	Time	Remark

For your kind attention and cooperation

Yours faithfully

....

NAM NGIEP 1 HYDROPOWER PROJECT
Investigation of Leakage Path at J27

INSPECTION REQUEST FROM

Contract Ref. No

NAM NGIEP1 POWER COMPANY

KENBER GEOTECTHNIC (THAILAND)CO.,LTD

INSPECTION REQUEST

IFR No. KBG-*NNP1_*...../.....
Date: ...../...../.....

Date & Time of inspection:...../...../..... **Time:**		**Location:**	
Item of Inspection:		**Status of Inspection:** ☐ First Inspection ☐ Re-Inspection	
Equipment to be Used: **Material to be Used:**		**Person in-Charge(PWG)**	
Preparation by:	**Request by:**	**Received by:**	**Inspection by:** ☐ Owner ☐ Self Inspection by KBG ☐ Other

INSPECTION RESULT/RECORD

Inspection by:	Date & Time of Inspection	Weather Condition

Equipment for Inspection: ☐ **Approval** ☐ **Rejection**

Reference of Document:

Inspection Comment: ☐ **Approval** ☐ **Rejection**

Signature:

NNP1PC

ACKNOWLEDGEMENT

Nam Ngiep 1 Power Company		KENBER GEOTECHNIC (THAILAND) CO.LTD

NOTE: TO BE RETURNED TO THE CONTRACTOR IMMEDIATELY AFTER FINAL EVALUATION

NAM NGIEP 1 POWER COMPANY

Drilling Report

Sheet ____ of ____

Date : ____ ☐ Day Shift ☐ Night Shift

Location : ____ Rig No.: ____

Chainage : ____ Hole No.: ____ Type of Drilling: ☐ Percussion drilling ☐ Rotary core drilling

Elevation (msl): ____ Dia. of Hole (mm) : ____ Drilling Bit Type: ☐ Button bit ☐ Diamond core bit

Water level (m): ____ Azimuth of Hole : ____ Degree Type of Drilling Pump : ____

Depth of Casing (m): ____ Inclination of Hole : ____ Degree from vertical Driller : ____

Time		Lap	Depth			Core Recovery		Soil/ Rock type	Drill Water or Drill Cutting Color	Remark
From (hr)	To (hr)	Time (hr)	From (m)	To (m)	Length (m)	Meter	%			

Prepared by :	Checked by :	Verified by :
Signature: ____ Name : ____ Date : ____	Signature: ____ Name : ____ Date : ____	Signature: ____ Name : ____ Date : ____

NAM NGIEP 1
POWER COMPANY

Grouting Repoort

Location: _____ Sheet_____of_____.

Station (km): _____ Hole No.: _____ Date : Shift _____

Elevation (msl): _____ Dia.of Hole(mm) : _____ Cement used (kg): _____

Results of water pressure tests (LU): _____ Packer Depth(m) : _____ Packer Type : _____ Cement take(kg) : _____

Mix ratio: _____ Inclination of Hole : _____ Degree. Cement take(kg/m) : _____

_____ Azimuth of Hole : _____ Degree. Grout Operator : _____

Stage no.	Grouting Method Up-Down Stage	Depth of Grouting		Time			W/C	Pressure		Injected Volume (litre)				Injected Materials					Remarks
		From (m)	To (m)	From (hr)	To (hr)	Lap Time (min)		Theoretical Pressure (kg/cm^2)	Actual Pressure (kg/cm^2)	Mix Volume (litre)	Total Volume (litre)	Injected Volume (litre)	Remained Volume (litre)	Cement (kg)	Water (litre)	Bentonite (kg)	Admixture (cc)	Sand (kg)	
Total																			

Prepared by :	Inspected by :	Verified by :
Signature:	Signature:	Signature:
Name :	Name :	Name :
Date :	Date :	Date :

NAM NGIEP 1
POWER COMPANY

RECORD OF GROUTING PROPERTIES

Meterials : 1). Water: _____kg. 2).Cement: _____kg. 3).Bentonite Slurry: _____kg . 4).Fly Ash: _____kg. 5) Admixture: _____kg.

Sampling Location : _____ Ambient Temp.(ºC) : _____ Water Temp(ºC) : _____ Sample No.: _____

Mix Ratio : W/C = Admixture = % of Cement, Bentonite = % of Cement, Sand = % of Cement, Date of Testing : Time of Mixing:

BLEEDING TEST

Time								
Time from Starting (minutes)	Start							
Starting Volume (V1), ml.								
Volume (V2), ml.								
Volume (Vg), ml.								
Volume (Vw), ml.								
Specified Bleeding (%)	≤ 5.0 %							
Tested Bleeding (%)								
Expansion (%)								

V1 = Volume of sample at begining of test, ml.
V2 = Volume of sample at prescribed intervals, ml
Vg = Volume of grout portion of sample at prescribed intervals, ml.
Vw = Volume of decanted bleed water, ml.
Expansion(%) = ((V2-V1)/V1)x100
Bleeding % = ((V2-Vg)/V1)x100
Final Bleeding % = (Vw/V1)x100

Final Bleeding = %

VISCOSITY TEST

Time								
Time from Starting (minutes)	Start							
Temperature ° C								
Specified Range of Viscosity (sec)								
Tested Viscosity (sec)								

Remarks: _____

Hole No. Mix No. Stage No. Depth of Grouting Grouting Status

DENSITY TEST

Time								
Time from Starting (minutes)	Start							
Theoretical Specified Gravity								
Tested Density (gm/cc)								

Prepared by :	Checked by :	Verified by :
Signature:	Signature:	Signature:
Name:	Name:	Name:
Date:	Date:	Date:

Appendix 8. Method for Testing Grout Mix Properties

Recommended Practice Standard Procedure for Field Testing Water-Based Drilling Fluids

1 Scope

The purpose of this recommended practice is to provide standard procedures for the testing of water-based drilling fluids. It is not a detailed manual on mud control procedures. It should be remembered that the agitation history and temperature of testing have a profound effect on mud properties.

This recommended practice is organized to follow the tests as listed on the API "Drilling Mud Report" form (API Recommended Practice 13G, Second Edition, May 1982). Additional tests are given in the Appendix of this recommended practice.

Metric SI unit equivalents have been included in this publication in parentheses following the U.S. customary units.

2 References

Unless otherwise specified, the most recent editions or revisions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard.

API

RP 13B-2	*Recommended Practice Standard Procedure for Field Testing Oil-Based Drilling Fluids*
Bul 13C	*Bulletin on Drilling Fluids Processing Equipment*
Bul 13D	*Bulletin on the Rheology of Oil Well Drilling Fluids*
RP 13E	*Recommended Practice for Shale Shaker Screen Cloth Designation*
RP 13G	*Recommended Practice for Drilling Mud Report Form*
RP 13I	*Recommended Practice for Laboratory Testing of Drilling Fluids*
RP 13J	*Recommended Practice for Testing Heavy Brines*
RP 13K	*Recommended Practice for Chemical Analysis of Barite*

3 Mud Weight (Density)

3.1 DESCRIPTION

This test procedure is a method for determining the weight of a given volume of liquid. Mud weight may be expressed as pounds per gallon (lb/gal), pounds per cubic foot (lb/ft^3), grams per cubic centimeter (g/cm^3), or kilograms per cubic meter (kg/m^3).

3.2 EQUIPMENT

The following equipment is needed:

a. Any instrument of sufficient accuracy to permit measurement within ±0.1 pound per gallon (or 0.5 pound per cubic foot, 0.01 gram per cubic centimeter, 10 kilograms per cubic meter) may be used. The mud balance (see Figures 1 and 2) is the instrument generally used for mud weight determinations. The mud balance is designed such that the mud cup at one end of the beam is balanced by a fixed counterweight at the other end, with a sliding-weight rider free to move along a graduated scale. A level-bubble is mounted on the beam to allow for accurate balancing. (Attachments for extending the range of the balance may be used when necessary.)
b. Thermometer: 32–220°F (0–105°C).

3.3 PROCEDURE

This test procedure should be followed:

a. Set the instrument base on a flat, level surface.
b. Measure the temperature of the mud and record it on the "Drilling Mud Report" form.
c. Fill the clean, dry cup with mud to be tested; put the cap on the filled mud cup and rotate the cap until it is firmly seated. Ensure that some of the mud is expelled through the hole in the cap in order to free any trapped air or gas (see Appendix D for air removal).
d. Holding the cap firmly on the mud cup (with the cap hole covered), wash or wipe the outside of the cup clean and dry.
e. Place the beam on the base support and balance it by moving the rider along the graduated scale. Balance is achieved when the bubble is under the center line.
f. Read the mud weight at the edge of the rider toward the mud cup. Make appropriate corrections when a range extender is used.

3.4 PROCEDURE—CALIBRATION

The instrument should be calibrated frequently with fresh water. Fresh water should give a reading of 8.3 pounds per gallon or 62.3 pounds per cubic foot (1000 kilograms per cubic meter) at 70°F (21°C). If it does not, adjust the balancing screw or the amount of lead shot in the well at the end of the graduated arm as required.

3.5 CALCULATION

The following are the steps for calculation:

a. Report the mud weight to the nearest 0.1 pound per gallon or 0.5 pound per cubic foot (0.01 gram per cubic meter, 10 kilograms per cubic meter).



FRONT VIEW



BACK VIEW

Figure 1—Mud Balance

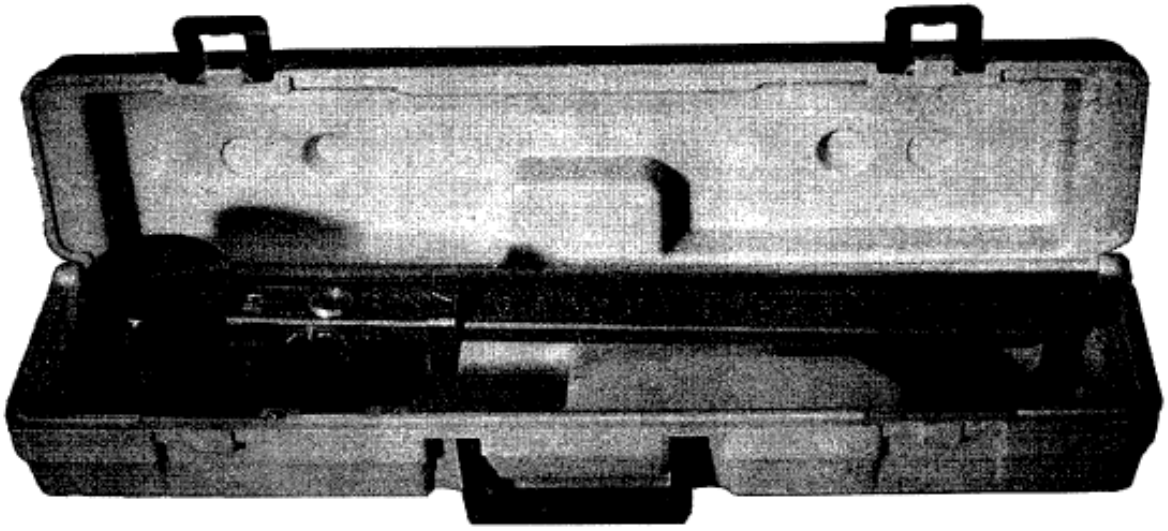


Figure 2—Mud Balance and Case

b. To convert the reading to other units, use the following:

$$Density = g/cm^3 = \frac{lb/ft^3}{62.3} = \frac{lb/gal}{8.345}$$

$$kg/m^3 = (lb/ft^3)(16) = (lb/gal)(120)$$

$$Mud\ gradient,\ psi/ft = \frac{lb/ft^3}{144},\ \frac{lb/gal}{19.24},\ \text{or}\ \frac{kg/m^3}{2309}$$

3.6 ALTERNATE MUD WEIGHT METHOD

3.6.1 Description

The density of a mud containing entrained air or gas can be determined more accurately by using the pressurized fluid density balance as described in this section. The pressurized fluid density balance is similar in operation to the conventional mud balance, the difference being that the slurry sample can be placed in a fixed-volume sample cut under pressure.

The purpose of placing the sample under pressure is to minimize the effect of entrained air or gas upon slurry density measurements. By pressurizing the sample cup, any entrained air or gas will be decreased to a negligible volume, thus providing a slurry density measurement more closely in agreement with that which will be realized under downhole conditions.

3.6.2 Equipment

The following equipment is needed for the alternate mud weight method:

a. Measurement device: Any instrument of sufficient accuracy to permit measurement within ±0.1 pound per gallon (or 0.5 pound per cubic foot, 0.01 gram per cubic meter, 10 kilograms per cubic meter) may be used. The pressurized mud balance (see Figures 3 and 4) is the instrument generally used for pressurized balance mud weight determinations. The pressurized mud balance is designed such that the mud cup and screw-on lid, at one end of the beam, is balanced by a fixed counterweight at the other end, with a sliding-weight rider free to move along a graduated scale. A level-bubble is mounted on the beam to allow for accurate balancing (see Figures 3 and 4).
b. Thermometer: 32–220°F (0–105°C).

3.6.3 Procedure

This test procedure should be followed for the alternate mud weight method:

a. Fill the sample cup to a level slightly below the upper edge of the cup [approximately 0.25 inch (6.4 millimeters)].
b. Place the lid on the cup with the attached check valve in the down (open) position. Push the lid downward into the mouth of the cup until surface contact is made between the outer skirt of the lid and the upper edge of the cup. Any excess slurry will be expelled through the check valve. When the lid has been placed on the cup, pull the check valve up in the closed position, rinse off the cup and threads with water, and screw the threaded cap on the cup.
c. The pressurizing plunger is similar in operation to a syringe. Fill the plunger by submersing its end in the slurry with the piston rod in the completely inward position. Then draw the piston rod upward, thereby filling the cylinder with slurry. This volume should be expelled with the plunger action and refilled with a fresh slurry sample to ensure that this plunger volume is not diluted with liquid remaining from the last clean-up of the plunger mechanism.
d. Push the nose of the plunger onto the mating O-ring surface of the cap valve. Pressurize the sample cup by maintaining a downward force on the cylinder housing in order to hold the check valve down (open) and at the same time forcing the piston rod inward. Approximately 50 pounds (225 newtons) force or greater should be maintained on the piston rod (see Figure 4).
e. The check valve in the lid is pressure actuated; when pressure is placed within the cup, the check valve is pushed upward into the closed position. To close the valve, gradually ease up on the cylinder housing while maintaining pressure on the piston rod. When the check valve closes, release pressure on the piston rod before disconnecting the plunger.
f. The pressurized slurry sample is now ready for weighing. Rinse the exterior of the cup and wipe dry. Place the instrument on the knife edge as illustrated. Move the sliding weight right or left until the beam is balanced. The beam is balanced when the attached bubble is centered between the two black marks. Read the density from one of the four calibrated scales on the arrow side of the sliding weight. The density can be read directly in units of pounds per gallon, specific gravity, pounds per square inch/1000 feet and pounds per cubic feet.
g. To release the pressure inside the cup, reconnect the empty plunger assembly and push downward on the cylinder housing.
h. Clean the cup and rinse thoroughly with water. For best operation in water-based slurries, the valve should be greased frequently with waterproof grease.

3.6.4 Procedure—Calibration

Calibrate the instrument frequently with fresh water. Fresh water should give a reading of 8.3 pounds per gallon or 62.3 pounds per cubic feet (1000 kilograms per cubic meter) at 70°F (21°C). If it does not, adjust the balancing screw or the amount of lead shot in the well at the end of the graduated arm as required.

3.6.5 Calculation

The following is the calculation procedure:

a. Report the mud weight to the nearest 0.1 pound per gallon or 0.5 pound per cubic foot (0.01 gram per cubic centimeter, 10 kilograms per cubic meter).

b. To convert the reading to other units, use the following:

$$Density = g/cm^3 = \frac{lb/ft^3}{62.43} = \frac{lb/gal}{8.345}$$

$$kg/m^3 = (lb/ft^3)\ (16) = (lb/gal)\ (120)$$

$$Mud\ gradient,\ psi/ft = \frac{lb/ft^3}{144} = \frac{lb/gal}{19.24} = \frac{kg/m^3}{2309}$$

c. A list of density conversions may be found in Table 1.

Table 1—Density Conversion

1	2	3	4
Pounds per Gallon (lb/gal)	Pounds per Cubic Foot (lb/ft^3)	Grams per Cubic Centimeter (g/cm^3)[a]	Kilograms per Cubic Meter (kg/m^3)
6.5	48.6	0.78	780
7.0	52.4	0.84	840
7.5	56.1	0.90	900
8.0	59.8	0.96	960
8.3	62.3	1.00	1000
8.5	63.6	1.02	1020
9.0	67.3	1.08	1080
9.5	71.1	1.14	1140
10.0	74.8	1.20	1200
10.5	78.5	1.26	1260
11.0	82.3	1.32	1320
11.5	86.0	1.38	1380
12.0	89.8	1.44	1440
12.5	93.5	1.50	1500
13.0	97.2	1.56	1560
13.5	101.0	1.62	1620
14.0	104.7	1.68	1680
14.5	108.5	1.74	1740
15.0	112.5	1.80	1800
15.5	115.9	1.86	1860
16.0	119.7	1.92	1920
16.5	123.4	1.98	1980
17.0	127.2	2.04	2040
17.5	130.9	2.10	2100
18.0	134.6	2.16	2160
18.5	138.4	2.22	2220
19.0	142.1	2.28	2280
19.5	145.9	2.34	2340
20.0	149.6	2.40	2400
20.5	153.3	2.46	2460
21.0	157.1	2.52	2520
21.5	160.8	2.58	2580
22.0	164.6	2.64	2640
22.5	168.3	2.70	2700
23.0	172.1	2.76	2760
23.5	175.8	2.82	2820
24.0	179.5	2.88	2880

[a]Same as specific gravity (sg).

4 Viscosity and Gel Strength

4.1 DESCRIPTION

The following instruments are used to measure viscosity and/or gel strength of drilling fluids:

a. Marsh funnel: a simple device for indicating viscosity on a routine basis.
b. Direct-indicating viscometer: a mechanical device for measurement of viscosity at varying shear rates.

Viscosity and gel strength are measurements that relate to the flow properties of muds. The study of deformation and flow of matter is called *rheology*. An in-depth discussion of rheology is made in API Bulletin 13D.

4.2 MARSH FUNNEL

4.2.1 Equipment

The following equipment is used:

a. Marsh funnel: a marsh funnel (see Figure 5) is calibrated to out-flow one quart (946 cubic centimeters) of fresh water at a temperature of 70 ±5°F (21 ±3°C) in 26 ±0.5 seconds. A graduated cup is used as a receiver. Specifications:

1. Funnel Cone:
   Length . . . . . 12.0 inches (305 millimeters).
   Diameter . . . . . 6.0 inches (152 millimeters).
   Capacity to the bottom
   of the screen . . . . . 1500 cubic centimeters.
2. Orifice:
   Length . . . . . 2.0 inches (50.8 millimeters).
   Inside Diameter . . . . . 3/16-inch (4.7 millimeters).
3. Screen: . . . . . 12 mesh.

The screen has 1/8-inch (1.6 millimeters) openings and is fixed at a level ¾ inch (19.0 millimeters) below the top of the funnel.
b. Graduated cup: one quart.
c. Stopwatch.
d. Thermometer: 32–220°F (0–105°C).

4.2.2 Procedure

This procedure should be followed:

a. Cover the funnel orifice with a finger and pour freshly sampled drilling fluid through the screen into the clean, upright funnel. Fill the funnel until the fluid reaches the bottom of the screen.
b. Remove finger and start the stopwatch. Measure the time for the mud to fill to the one-quart (946-cubic centimeter) mark of the cup.
c. Measure the temperature of fluid in °F (°C).
d. Report the time to the nearest second as marsh funnel viscosity. Report the temperature of the fluid to the nearest °F (°C).



Figure 5—Marsh Funnel and Cup

4.3 DIRECT-INDICATING VISCOMETER

4.3.1 Equipment

The following equipment is used:

a. Direct-indicating viscometers: These are rotational types of instruments powered by an electric motor or a hand crank. Drilling fluid is contained in the annular space between two concentric cylinders. The outer cylinder or rotor sleeve is driven at a constant rotational velocity (revolutions per minute). The rotation of the rotor sleeve in the fluid produces a torque on the inner cylinder or bob. A torsion spring restrains the movement of the bob, and a dial attached to the bob indicates displacement of the bob.

Instrument constants have been adjusted so that plastic viscosity and yield point are obtained by using readings from rotor sleeve speeds of 300 revolutions per minute and 600 revolutions per minute.

Specifications—Direct-indicating viscometer:

1. Rotor Sleeve:
Inside diameter. . . . . .1.450 inches (36.83 millimeters).
Total length . . . . . 3.425 inches (87.00 millimeters).
Scribed line . . . . . 2.30 inches (58.4 millimeters).
These dimensions are above the bottom of the sleeve.
There are two rows of ⅛-inch (3.18-millimeter) holes spaced 120 degrees (2.09 radians) apart, around the rotor sleeve just below the scribed line.

2. Bob:
Diameter . . . . . 1.358 inches (34.49 millimeters).
Cylinder length . . . . . 1.496 inches (38.00 millimeters).
The bob is closed with a flat base and a tapered top.

3. Torsion spring constant: 386 dyne-centimeters/degree deflection.

4. Rotor speeds:
High speed. . . . . .600 revolutions per minute.
Low speed . . . . . .300 revolutions per minute.

b. Types of viscometers used to test drilling fluids:

1. Hand-cranked instrument (see Figure 6) has speeds of 300 revolutions per minute and 600 revolutions per minute. A knob on the hub of the speed-change lever is used to determine gel strength.

2. The 12-volt, motor-driven instrument (Figure 7) also has speeds of 300 revolutions per minute and 600 revolutions per minute. A governor-release switch permits high shearing before measurement, and a knurled hand-wheel is used to determine gel strength.

3. The 115-volt instrument (Figure 8) is powered by a two-speed synchronous motor to obtain speeds of 3, 6, 100, 200, 300, and 600 revolutions per minute. The 3-revolutions per minute speed is used to determine gel strength.

4. The variable speed 115-volt or 240-volt instrument (Figure 9) is motor powered to obtain all speeds between 1-revolution per minute and 625 revolutions per minute. The 3-revolutions per minute speed is used to determine gel strength.

c. Stopwatch.

d. Suitable container, for example, the cup provided with the viscometer.

e. Thermometer: 32°F–220°F (0°C–105°C).

4.3.2 Procedure

CAUTION: Maximum operating temperature is 200°F (93°C). If fluids above 200°F (93°C) are to be tested, a solid metal bob or a hollow metal bob with a completely dry interior should be used. Liquid trapped inside a hollow bob may vaporize when immersed in high-temperature fluid and cause the bob to explode.

This procedure should be followed:

a. Place a sample in the container and immerse the rotor sleeve exactly to the scribed line. Make measurements in the field with minimum delay (within five minutes, if possible) and at a temperature as near as is practical to that of the mud at the place of sampling [not to differ more than 10°F (6°C)]. State the place of sampling on the report.

b. Record the temperature of the sample.

c. With the sleeve rotating at 600 revolutions per minute, wait for the dial reading to reach a steady value (the time required is dependent on the mud characteristics). Record the dial reading for 600 revolutions per minute.

d. Shift to 300 revolutions per minute and wait for the dial reading to reach steady value. Record the dial reading for 300 revolutions per minute.

Designation: C 940 – 98a

Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory[1]

This standard is issued under the fixed designation C 940; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method determines the amount of expansion and accumulation of bleed water at the surface of freshly mixed hydraulic-cement grout used in the production of preplaced-aggregate (PA) concrete.

1.2 It is for use with cement grout whether or not it includes fine aggregate or mineral admixtures or both.

1.3 The values stated in SI units are to be regarded as standard.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 125 Terminology Relating to Concrete and Concrete Aggregates[2]

C 937 Specification for Grout Fluidifier for Preplaced-Aggregate Concrete[2]

3. Terminology

3.1 *Definition of Terms*—Terms used in this test method are defined in Terminology C 125 or in this section.

3.1.1 *expansion*—increase in the volume of a grout, expressed as a percentage of the original volume of the grout.

3.1.2 *bleeding*—This term is defined as stated in Terminology C 125, with the exception that it pertains to grout in this test method.

4. Summary of Test Method

4.1 Grout is placed in a graduated cylinder. Changes in total volume and accumulation of bleed water, if any, on the surface of the grout are observed over a period of time.

5. Significance and Use

5.1 This method is useful for determining the expansion and bleeding characteristics of freshly mixed fluid grout used in PA concrete.

6. Interferences

6.1 Failure to obtain a uniformly smooth mixture, free of lumps, will cause excessive bleeding and may result in reduced expansion.

6.2 The capability of most admixtures to produce expansion and the tendency to bleed is related to the temperature of the grout during the period of test.

7. Apparatus

7.1 *Glass Graduate*, 1000 mL, reading to 10 mL.

7.2 *Glass Graduate*, 25 mL, reading to 1 mL.

7.3 *Thermometer*, accurate to 0.5°C (1°F) for measuring grout and air temperature.

8. Test Sample

8.1 The grout test sample shall consist of approximately 1500 mL and shall be representative of the grout in the mixer.

9. Procedure

9.1 When sampling and testing are being performed in the laboratory for the purpose of designing or comparing mixtures or for qualifying admixtures including grout fluidifiers proceed in the following manner:

9.1.1 Maintain the ambient temperature of the room in which the test is performed at 23.0 ± 2°C (73.4 ± 3°F), unless otherwise specified.

9.1.2 Bring the temperature of all dry materials and mixing water to a constant temperature of 23.0 ± 2°C (73.4 ± 3°F) before mixing, unless otherwise specified.

9.1.3 Start volume measurements within 3 min of completion of mixing.

9.2 When sampling and testing are being performed in the field, record the temperature of the grout sample and the ambient temperature of the area in which the test readings are made. Record the time interval between completion of mixing and start of test.

9.3 Immediately after the completion of mixing, measure the temperature of the grout. Then introduce the grout into a

[1] This test method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.41 on Concrete for Radiation Shielding.

Current edition approved May 10, 1998. Published December 1998. Originally published as C 940 – 81. Last previous edition C 940 – 98.

[2] *Annual Book of ASTM Standards*, Vol 04.02.

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1000-mL graduated cylinder until the volume of the sample is 800 ± 10 mL. Record the volume of the sample and the time at which the reading was made. Place the graduated cylinder on a level surface free of vibration. Cover to prevent evaporation of the bleed water.

9.4 Take and record the readings, estimated to the nearest 1 mL, of the upper surfaces of the grout and bleed water, if any, of the sample in the graduate at 15-min intervals for the first 60 min and thereafter at hourly intervals until two successive readings show no further expansion or bleeding. When the test for expansion and bleeding is used in connection with Specification C 937, it shall be discontinued 3 h after the initial reading.

9.5 At the conclusion of the test, decant the bleed water into a 25-mL graduate by tilting the specimen and drawing the water off with a pipet or large medicine dropper. Record the final volume of bleed water to the nearest 0.5 mL.

10. Calculation

10.1 Calculate the expansion of the grout, and its bleeding and the combined expansion of grout plus bleed water as percentages of the initial volume of the grout, as follows:

$$\text{Expansion, \%} = \frac{V_g - V_1}{V_1} \times 100$$

$$\text{Bleeding, \%} = \frac{V_2 - V_g}{V_1} \times 100 \text{ at prescribed intervals}$$

$$\text{Combined Expansion, \%} = \frac{V_2 - V_1}{V_1} \times 100$$

$$\text{Final bleeding, \%} = \frac{V_w}{V_1} \times 100$$

where:

V_1 = volume of sample at beginning of test, mL,
V_2 = volume of sample at prescribed intervals, measured at upper surface of water layer, mL,
V_g = volume of grout portion of sample at prescribed intervals, at upper surface of grout, mL, and
V_w = volume of decanted bleed water, mL.

11. Report

11.1 The report shall include the following:

11.1.1 Identification of the grout sample.

11.1.2 Expansion of grout to the nearest 0.2 % for each prescribed interval.

11.1.3 Bleeding of grout to the nearest 0.2 % for each prescribed interval.

11.1.4 Combined expansion of grout plus bleed water to the nearest 0.2 % for each prescribed interval.

11.1.5 Final bleeding to nearest 0.2 %.

11.1.6 Temperature of grout sample at start of test.

11.1.7 Ambient temperature of laboratory or testing area at the beginning and end of test.

12. Precision and Bias

12.1 *Precision*:

12.1.1 *Bleeding*—The single laboratory, three operators, standard deviation has been found to be 0.06 %. Therefore, results from two properly conducted tests (by the same operator) on the same material should not differ by more than 0.17 %.

12.1.2 *Combined Expansion*—The single laboratory, three operators, standard deviation has been found to be 0.37 %. Therefore, results from two properly conducted tests (by the same operator) on the same material should not differ by more than 1.04 %.

12.2 *Bias*—No statements on bias can be prepared because there are no standard reference materials.

13. Keywords

13.1 bleeding; concrete; expansion; grouts; preplaced-aggregate; preplaced-aggregate concrete

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APPENDIX 7: EMO COMMENTS & CONTRACTOR'S RESPONSES TO SSESMMP - INVESTIGATION OF LEAKAGE PATH AT J27

NAM NGIEP 1 POWER COMPANY

EMO Document Approval Sheet

No......
Date: 03 June 2025

Subject: No objection with Comments for the Detail Works Program (DWP) and Site Specific Environmental & Social Management and Monitoring Plan (SS-ESMMP) for Investigation of leakage path at J27 of the Main Dam for Nam Ngiep 1 Hydropower Project.

MD

Main []

DMD	**Mgr/AM**	**Staff**

CO/C.C [Environmental and Social Department]

DMD	**Mgr/AM**	**Staff**
	Khamsone XAYSOMPHOU 03 June 2025	Keethao BUALEE 02 June 2025

CO/C.C [ ]

DMD	**Mgr/AM**	**Staff**

Brief Explanation

EMO reviewed the first submission DWP and SS-ESMMP for Investigation of leakage path at J27 of Main Dam for Nam Ngiep 1 Hydropower Project submitted on 02 June 2025 by Kenber Geotechnic (Thailand) Co., Ltd. After reviewing, EMO has no objection with comments to the mentioned document. More detailed comments can be found in the attached comment sheet. **The Contractor may proceed with the proposed activity, pending submission of the revised document, and is required to submit a revised document addressing EMO's comments within 10 business days for review and clearance.**

EMO Responses for the Submitted DWP & SS-ESMMP

Document Name:	The First submission of the Detailed Works Program (DWP) and Site Specific and Environmental & Social Management and Monitoring Plan (SS-ESMMP) for Investigation of leakage path at J27 of Main Dam for Nam Ngiep 1 Hydropower Project.			
Reference No.:	N/A			
Project Owner:	NNP1PC (TD)			
Submitted By:	Kenber Geotechnic (Thailand) Co., Ltd.		**Date Received by EMO:**	02 June 2025
Please Tick the box:	**First Submission** √	**Second Submission**	**First Submission Date:**	02 June 2025
Assessed By:	Keethao BOUALEE Team Leader-Compliance and Waste Management		**Date:**	03 June 2025
Reviewed and Approved By:	Khamsone XAYSOMPHOU Manager-EMO		**Date:**	03 June 2025
Status:	No objection with comments			

1. General Comments

Following the review of the proposed document, EMO has identified comments and observations related to both the Detailed Work Plan (DWP) and the Site-Specific Environmental and Social Management and Monitoring Plan (SSESMMP), as outlined in Section 2 below. The Contractor may proceed with the proposed activity pending submission of the revised document.

As required by the Standard Operating Procedures (SOP) for document assessment and review of the NNP1PC, the Contractor is requested to submit a revised document addressing the Environmental Management Office's (EMO) comments within 10 business days for review and clearance.

2. Specific Comments

Page No.	Section	NNP1 PC Comments (Please note that if the following comments cannot be addressed, a response is required)	Response and date for completion by: Kenber Geotechnic (Thailand) Co., Ltd.	Priority
Detailed Work Program (DWP) and Site Specific and Environmental & Social Management and Monitoring Plan (SS-ESMMP)				
6 12 17	5.3 9.2 SP02	**Please provide the following details regarding the use of Rheobuild 1008:** • The total quantity of Rheobuild 1008 to be transported to the NNP1PC site**;** • The specific storage location and description of the storage facility for the admixture; • A copy of the Material Safety Data Sheet (MSDS) for Rheobuild 1008.		**Medium**
9 12 17	7.4 9.2 SP02	**Please provide the following details regarding the use of Hydrochloric acid (HCl):** • The total quantity of HCl to be transported to the NNP1PC site**;** • The specific storage location and description of the storage facility for the HCl; • A copy of the Material Safety Data Sheet (MSDS) for HCl		**High**
9 n/a 17	7.4 Appendix 6 SP04	**Schematic Diagram of Sedimentation Pond:** • Please provide an estimated daily volume of wastewater generated from 1). drilling activities and 2). grounding operations (based on the scope of work), to verify whether the proposed sedimentation pond capacity of 4 m^3 is adequate. • In the appendix 6, please indicate the exact location of the treatment		**Medium**

		system to be installed on-site.		
02 15	12.2 Table 2	**Camp and office Establishment** In Section 2, Scope of Work (page 4), Item A-2 indicates the requirement to set up a temporary camp and site office. However, Table 2, Environmental Assessment Checklist, states “No camp and office set up.” **Please clarify:** **If Kenber Geotechnic (Thailand) Co., Ltd. intends to establish a camp on site, please provide the following details:** • A site layout map showing the proposed location of the camp and its key facility including (but not limited to) accommodation areas, workshop, fuel storage, parking area, kitchen, toilets, wastewater pond, and drainage system. • A waste management plan for the camp, covering the handling of general waste, food waste, hazardous waste, wastewater, and septic tank waste (specifying procedures for collection, segregation, storage, and disposal). **If the Kenber Geotechnic (Thailand) Co., Ltd intends to use a rented house or guesthouse for accommodation:** • A detailed description and map of the location must be provided. The Kenber should indicate where equipment, tools and admixture chemicals will be kept and maintained. • Preventive measures for oil and admixture chemical spillage and contamination during equipment and tools keeping and maintenance operations must be clearly outlined.		**Medium**

Project : Nam Ngiep 1 Hydropower Project
Package : Survey of Leakage Path
Date : 16-Sep-2025

COMMENT LIST FOR DWP AND SS-ESMMP

No.	Page	Subject	Comment from EMO	Answer from Kenber Geotechnic (Thailand) Co., Ltd (Contractor)	Reply from EMO	Condition
SSESM						
	Page 6, 12,17	Section 5.3, 9.2, SP02	Please provide the following details regarding the use of Rheobuild 1008: •The total quantity of Rheobuild 1008 to be transported to the NNP1PC site; •The specific storage location and description of the storage facility for the admixture; •A copy of the Material Safety Data Sheet (MSDS) for Rheobuild 1008.	Please see Appendix 3	Quantity is missing. **EMO:** Appendix 3 provides general information about the product. Please also attach the MSDS of the mentioned product.	**EMO record:** No use of these admixture
	Page 9, 12,17	Section 7.4, 9.2, SP02	Please provide the following details regarding the use of Hydrochloric acid (HCl): •The total quantity of HCl to be transported to the NNP1PC site; •The specific storage location and description of the storage facility for the HCl; •A copy of the Material Safety Data Sheet (MSDS) for HCl	If the volume of wasted water from grout is small volume, the pump will be used to spray the wasted water to the ground where is near wasted water pond. If there is large volume, vinegar may be used to adjust the pH value of the water. If vinegar MSDS is required, it will be submitted later.	We understood Kenber will not use HCl basically. If Kenber need to use HCl, Kenber submit doument sepaaratly.	**EMO record: Refer to a monthly joint site inspection _No significant issue**
	Page 9, N/A,17	Section 7.4, Appendix6, SP04	Schematic Diagram of Sedimentation Pond: • Please provide an estimated daily volume of wastewater generated from 1). drillin activities and 2). grounding operations (based on the scope of work), to verify whether the proposed sedimentation pond capacity of 4 m³ is adequate. • In the appendix 6, please indicate the exact location of the treatment system to b installed on-site.	The wasted water from drilling work will be filted for sediment and cutting partical before drain directly to Nam Ngiep River at the upstream side. The wasted water from grout is small volume, the 4 m3 is adequate. Noted.	We understood quantity is very small and 4m3 is sufficient judging from actual site condition.	**EMO record:** Refer to a monthly joint site inspection _No significant issue
	Page 2, 15	Section 12.2, Table2	Camp and office Establishment In Section 2, Scope of Work (page 4), Item A-2 indicates the requirement to set up a temporary camp and site office. However, Table 2, Environmental Assessment Checklist, states “No camp and office set up.” Please clarify: If Kenber Geotechnic (Thailand) Co., Ltd. intends to establish a camp on site, please provide the following details: • A site layout map showing the proposed location of the camp and its key facili including (but not limited to) accommodation areas, workshop, fuel storage, parking area, kitchen, toilets, wastewater pond, and drainage system. • A waste management plan for the camp, covering the handling of general waste, foo waste, hazardous waste, wastewater, and septic tank waste (specifying procedures for collection, segregation, storage, and disposal). If the Kenber Geotechnic (Thailand) Co., Ltd intends to use a rented house or guesthouse for accommodation: • A detailed description and map of the location must be provided. The Kenber shou indicate where equipment, tools and admixture chemicals will be kept and maintained. • Preventive measures for oil and admixture chemical spillage and contamination durin equipment and tools keeping and maintenance operations must be clearly outlined.	Noted. Please see Appendix 6	It would be OK. EMO team, please confirm it. **EMO:** The rented house was included in the inspection list, and EMO, together with TD, will inspect it regularly.	**EMO record:** Refer to a monthly joint site inspection _No significant issue